Bighorn National Forest Plan Revision
Existing Condition Assessment

Tongue River

Geographic Area Assessment

Picture of Tongue River Box Canyon

Tongue Geographic Area Existing Condition Assessment for Forest Plan Revision

Appendix: Maps

I. Preface

This is one of nine geographic area existing condition assessments that will be used in the Bighorn Forest Plan Revision to describe resources at the geographic area scale and how they relate to the existing Forest Plan. A map of the Forest Plan revision geographic areas is in the appendix. A similar assessment will be done at the Forest-wide scale, and will include numerous resources/topics:

- that are not amenable to analysis at the geographic area scale. For example, most wildlife species are not bound by geographic area boundaries, and to avoid needless repetition in the assessments, such topics will only be discussed at the Forest scale.
- where databases are not complete or where analysis is still on going at the time the geographic area scale assessments are completed. Examples in this category are fire condition classes and timber suitability, which are expected to be completed by early 2002.

This existing condition geographic area assessment includes the portions of the Tongue River watershed that occur on the Bighorn National Forest, unless noted otherwise.

There is very little information in this assessment concerning other than National Forest System land. This information will be gathered and analyzed, where appropriate, in the draft and final environmental impact statements' effects analyses.

These existing condition assessments focus on the physical and biological resources, and in some cases, human uses and resources, such as timber harvest, grazing and recreation. There will be a social and economic section in the Forest-wide existing condition assessment, and the draft and final environmental impact statements will also include the work of the social and economic analyses, which are currently being compiled by the University of Wyoming.

Despite the fact that these assessments primarily focus on the environmental effects of human uses, it must be remembered that National Forests are managed *to be used* by people. This is implicit in the laws governing National Forest management[1]. Human use of the National Forests has been directed administratively since the earliest days of the Forest Service, "This force has two chief duties: to protect the reserves against fire, and to assist the people in their use."[2] That tradition continues to this day in the "Caring for the land and serving people" mission. While these assessments focus on the environmental effects that people are having on the resource, the point is to make sure that the uses we enjoy today are sustainable so that our children and grandchildren can continue to use and enjoy the Bighorn National Forest.

Disclaimer for GIS generated data: The Forest Service uses the most current and complete data available. GIS data and product accuracy may vary. They may be: developed from sources of differing accuracy, accurate only at certain scales, based on modeling or interpretation, incomplete while being created or revised, etc. Using GIS products for purposes other than those for which they were created, may yield inaccurate or misleading results. The Forest Service reserves the right to correct, update, modify or replace GIS products without notification. The GIS data in these documents were generated using ArcInfo 7.2.1, operating on a Unix platform, with analysis occurring between August of 2001 and January of 2002. For more information, contact the Bighorn National Forest.

[1] The Multiple Use Sustained Yield Act of 1960, the Renewable Resources Planning Act, and the National Forest Management Act, just to name a few.
[2] Forest Service "Use Book" of 1905.

II. Forest Plan

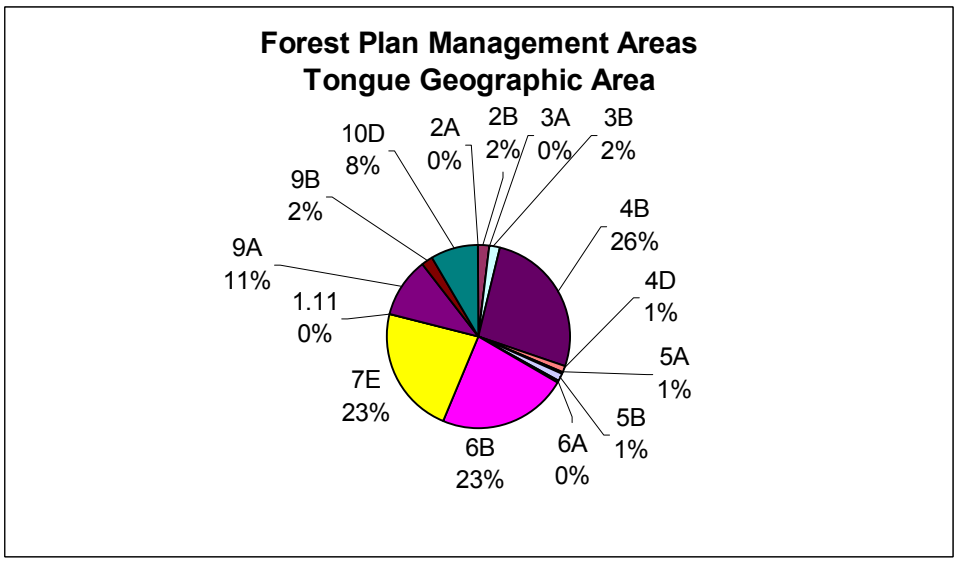
Table 1. Existing Forest Plan Management Area Allocations

Forest Plan Prescriptions	Prescription Description	GIS Acres with 9A Riparian Applied	
		Acres	%
2A	Semi-Primitive Motorized Recreation Opportunities	2	0%
2B	Rural and Roaded Natural Recreation Opportunities	3146	2%
3A	Semi-Primitive Nonmotorized Recreation Opportunities	73	0%
3B	Primitive Recreation in Unroaded Areas	3780	2%
4B	Wildlife Habitat Management for Management Indicator Species	45,715	26%
4D	Aspen Stand Management	1764	1%
5A		924	1%
5B	Wildlife Winter Range in Forested Areas	2441	1%
6A	Livestock Grazing, Improve Forage Condition	16	0%
6B	Livestock Grazing, Maintain Forage Condition	39,828	23%
7E	Wood Fiber Production	39,640	23%
1.11	Pristine Wilderness	5	0%
9A	Riparian and Aquatic Ecosystem Management	18,706	11%
9B	Increase Water Yield	3730	2%
10D	Wild and Scenic Rivers Corridors	14,530	8%
Total		174,300	
Non-FS		2769	

Some interpretations from Table 1 include:

- Commodity emphasis prescriptions of 6* and 7E account for 46% of the geographic area.
- Next high is 26% for 4B.
- These four prescriptions account for 72% of this geographic area.

Figure 1. Existing Forest Plan Management Area Allocations



Comparison of existing condition to FP goals and objectives and standards and guidelines

- 16 acres of 6A prescription – has that improved to 6B, maintain?
- Portions of Big Willow Creek and Bull Creek have a Forest Plan Management Area allocation of 9B, which emphasizes increased water yield and improved timing of flow through manipulation of forest vegetation.
    - This takes removal of 24% or more of the basal area in a geographic area.
    - If the entire geographic area is not allocated to this emphasis, little potential to affect water yield.
    - These geographic areas have substantial portions in grass/forbs habitats, so it is unlikely any increase in water yield would be noticeable.

What is broken and needs to be fixed in the Forest Plan?

- Resource damage from motorized vehicles driving off-road in areas open to cross country travel ("C" areas on the travel map) needs to be addressed.
- 9B prescription – see above.
- MIS species selection, modeling (elk habitat), and monitoring provisions.
- Riparian and Aspen communities forage utilization standards and guidelines.
- Road Density standards/guidelines need incorporated for elk security habitat.
- Revise the standard/guideline regarding old growth.
- Vacant allotments need consideration for bighorn sheep reintroduction.
- Fences rebuilt/constructed need to have wildlife passage considered.

What are the issues in this geographic area?

- Wild and Scenic allocation in Tongue River.
- Tongue River is Class I watershed, highest ranking for fisheries and water quality, yet geographic area is largely managed for multiple use.
- Tongue River Cave and another cave management: garbage/graffiti and sensitive species habitat for two bat species.
- Number of poor condition closed timber sale roads.
- Allotment Management Plan EA currently being done on Tongue. Areas of heavy livestock use in highest quality fishery stream on Bighorn National Forest.
- Relatively high concentration of motorized uses.
- Gloom/Quartz Creeks area – Forest Plan Prescription of 7E and suited timber, large remaining security block, roadless under 1983 Appendix M.
- High moose concentrations and browsing on willows; only rivaled by Sourdough Creek.
- High concentrations of hunter camps and associated impacts in Walker Prairie area.
- Riparian and aspen impacts (past and present) may be affecting wildlife habitat quality, with amphibian populations of particular concern. Less beaver than previously thought to exist, consider this species as possible MIS/Focal.
- High road density has lowered the amount of elk security habitat. This type of habitat can be an indicator for other species benefiting from less disturbance (e.g. marten).
- Protection of cave/karst resources from recreational impact.

III. Disturbance Factors

Riparian

Disturbance influences upon riparian areas and riparian vegetation are discussed in the Forest-wide assessment.

Fire

Over the long term, fire is the most dominant disturbance factor in this landscape, from the perspective of total number of acres affected. A very small percentage of fires affect a majority of the acre burned.

- Fires role is different among the major forest cover types of ponderosa pine, Douglas fir, limber pine, lodgepole pine and Engelmann spruce/subalpine fir. These are described in more detail in Knight, 2001, and will be summarized in the forest-wide assessment.
- Known fires over 1000 acres in the Tongue geographic area:
    - 1910: Little Tongue, 2473 acres.
    - 1916: Black Mountain, 5367 acres.
    - 1919: Wolf Creek, 1803 acres.
    - 1919: Bonanza, 1422 acres.
    - 1919: Red Gulch and Bear Creek totaled 578 acres.

Insect and Disease

- Insect and disease are the second most dominant disturbance factor in this geographic area.
- Disturbance caused by insects and disease differs among the cover types present in the geographic area.
    - Ponderosa Pine along US 14 on the face of the mountain has mountain pine beetle that is nearing epidemic proportions. Recent investigations by Sheridan College biology students show that the area affected continues to increase. The condition of the ponderosa pine forests on the face are prime for mountain pine beetles: high density, 8" + diameter, 80 to 100 years old. This condition is outside the historic range of variability (HRV) due to fire suppression this century (Knight, 2001).
    - Limber pine throughout the geographic area is being affected by white pine blister rust. A non-native species, white pine blister rust attacks 5 needle pines, and has two hosts during it's life cycle, Ribes sp. and limber pine. This is considered to be one of the most significant potential ecological impacts currently occurring on the Bighorn (Knight, 2001), as the potential is for near eradication of this species on the Forest.

Wind

Wind has played an important disturbance role in this geographic area, as evidenced by the 1991 blowdown event. Approximately 1200 acres were affected in the South Tongue watershed. The area affected was a strip approximately ¼ to ¾ of a mile wide, and several miles long. The affect was intermittent, in that the blowdown areas are disconnected by grasslands and timbered areas that were not affected. The blowdown ranged from all trees blown over, to only a few blown over. In some cases, the trees were broken off 10 to 30 feet above the ground, leaving limbless snags standing. Most of the area affected was lodgepole pine forests.

These wind events have occurred periodically in the Big Horn Mountains. They are caused by "collapsing thunderstorms" that originate over the Big Horn Basin. As they move to the east and hit the abrupt rise of the Big Horn Mountains, they cool dramatically and "collapse" with violent downbursts. The southwest to northeast orientation of the path of these storms is typical of the prevailing summer time air flow.

Timber Harvest

Both the North and South Tongue were heavily impacted by tie-hacking in the 1890s to about 1910. The ties were sent down the tie flume through Tongue River Canyon to Dayton for processing. An excellent history of the Tongue River tie-hacking is available at the Sheridan County Library. The legacy of the tie-hacking in this area upon lodgepole pine genetics is documented in a report on file at the Bighorn NF offices in Sheridan (Howe, 1997). Basically, tie hacking has clearly a high-grade operation that left the "sick, lame and lazy" as regeneration sources for the lodgepole that has regenerated since the tie hacking occurred.

Table 2 shows the amount of timber harvest and fire since the 1940s. The timber harvests are from the RIS tables, and the fire acreages are from the historic fire database.

Table 2. Timber Harvest and Fires in the Tongue Analysis Area

Harvest Type	1940's	1950's	1960's	1970's	1980's	1990's	2000
Clearcut			3559	1212	406	712	
Shelterwood: Prep Cut			64	1102	3103	61	
Shelterwood: Seed Cut						558	
Shelterwood: Overstory Removal				60		844	
Seed Tree							
Selection					98	68	
Commercial Thin				12	1208	98	
Sanitation/Salvage				60	20	881	
Pre-commercial Thin					2327	855	
Aspen Clearcut					2	5	
Fire		91				651	
Blowdown						1200	
Acres CC + SW + ST + S + S/S[3]			3623	2434	3627	3124	

Some of the insights from table 2 are:

- The "silviculture of the decade" is very evident in this geographic area. In the 1960's, several hundred acre clearcuts, primarily in lodgepole pine was the prescription of choice, especially in the South Tongue south of Tie Flume campground. By the late 1980's, lodgepole clearcuts were at the 10-40 acre scale, such as Blue Creek and Gloom Creek. The landscape pattern that has resulted from these different scales of clearcuts will continue to produce different habitat conditions into the future – there is more edge habitat and the future patch size will be smaller with the Blue Creek, 10-40 acre, patches.
- The blowdown in 1991 ran from US 14 to near Black Mountain in a sporadic pattern. Most of the easily accessible area of the blowdown was salvage logged.

Tinker, et al, 1998 quantifies fragmentation caused by timber harvest and roads on the Bighorn National Forest. That analysis and conclusions are presented in the Forest wide portion of the

[3] CC = Clearcut, SW = Shelterwood, ST = Seed Tree, S = Selection, S/S = Sanitation/Salvage. These were summed to portray the amount of sawlog harvest that has occurred.

Forest Plan Revision existing condition assessment, rather than in each geographic area discussion.

Figure 2 shows the relative amounts of suited timber by geographic area. About 54% of the Tongue forested area is currently classified as suitable for timber harvest. This table could be considered an indicator of the relative amount of forested area that is *available* for timber production purposes. This is the second highest percentage, and reflects the long history of timber management emphasis in this geographic area.

Figure 2. Amount of Forested Area Available That is Suited Timber, by Geographic Area

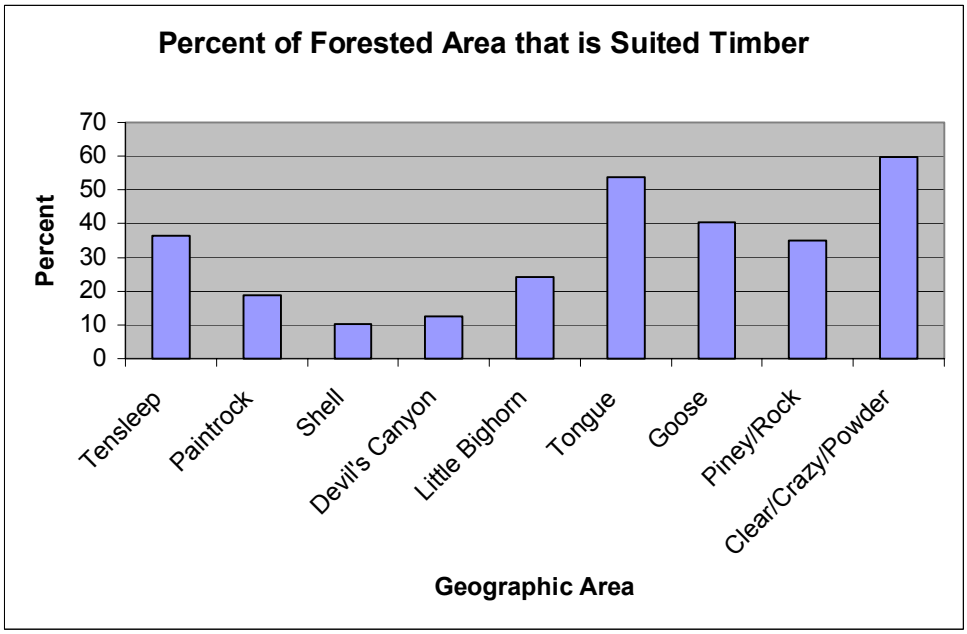


Figure 3 shows the percentage of the suited timber area that has received a final harvest (clearcut, shelterwood removal or seed cut, selection harvests) or stand-replacing fire or blowdown between 1960 and 2000. This is an indicator of the *intensity* of forest successional change, as it indicates how much of the suited land has actually had a stand replacing event between 1960 and 2000. This is from the RIS activity database and includes the time between January 1, 1960 and February 1, 2000. Each bar is divided into “fire and blowdown” and “timber harvest” to show the relative amounts of each type of disturbance.

Figure 4 shows the percentage of all forested lands that has received a final harvest (clearcut, shelterwood removal or seed cut, selection harvests) or stand-replacing fire or blowdown between 1960 and 2000. This is an indicator of the *intensity* of forest successional change, as it indicates how much of the forested area has actually had a stand-replacing event between 1960 and 2000. This is from the RIS activity database and includes the time between January 1, 1960 and February 1, 2000. Each bar is divided into “fire and blowdown” and “timber harvest” to show the relative amounts of each type of disturbance.

Figure 3. Percent of Suited Timber that Received a Stand Replacing Event, 1960-2000

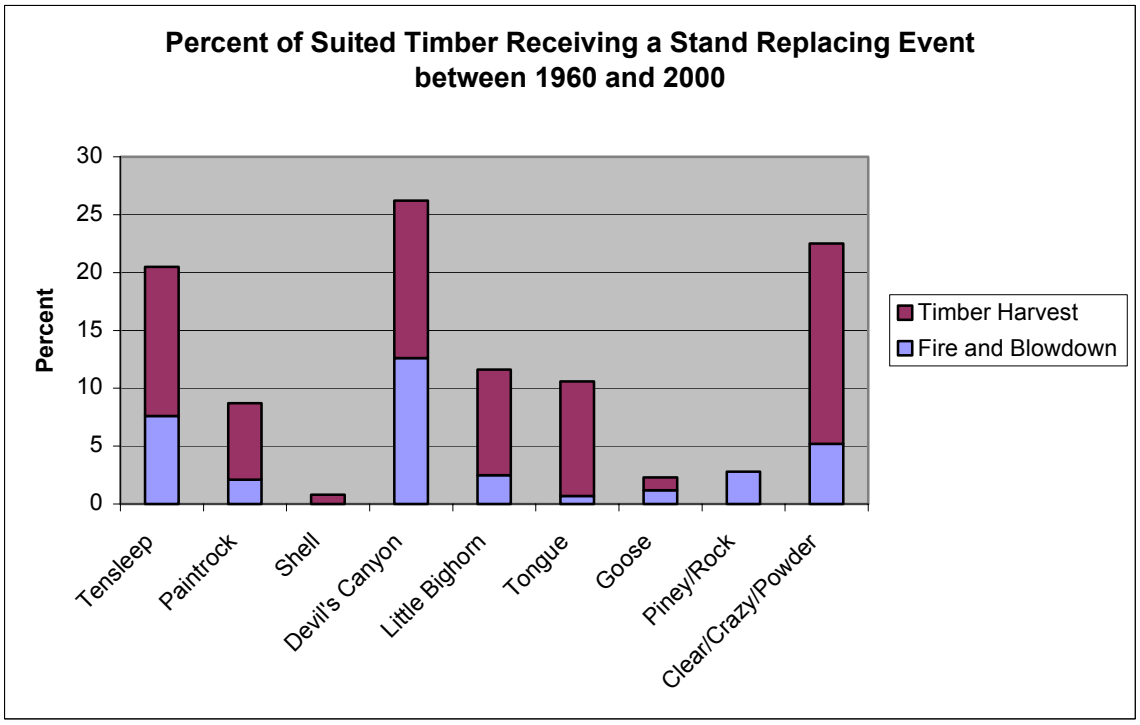
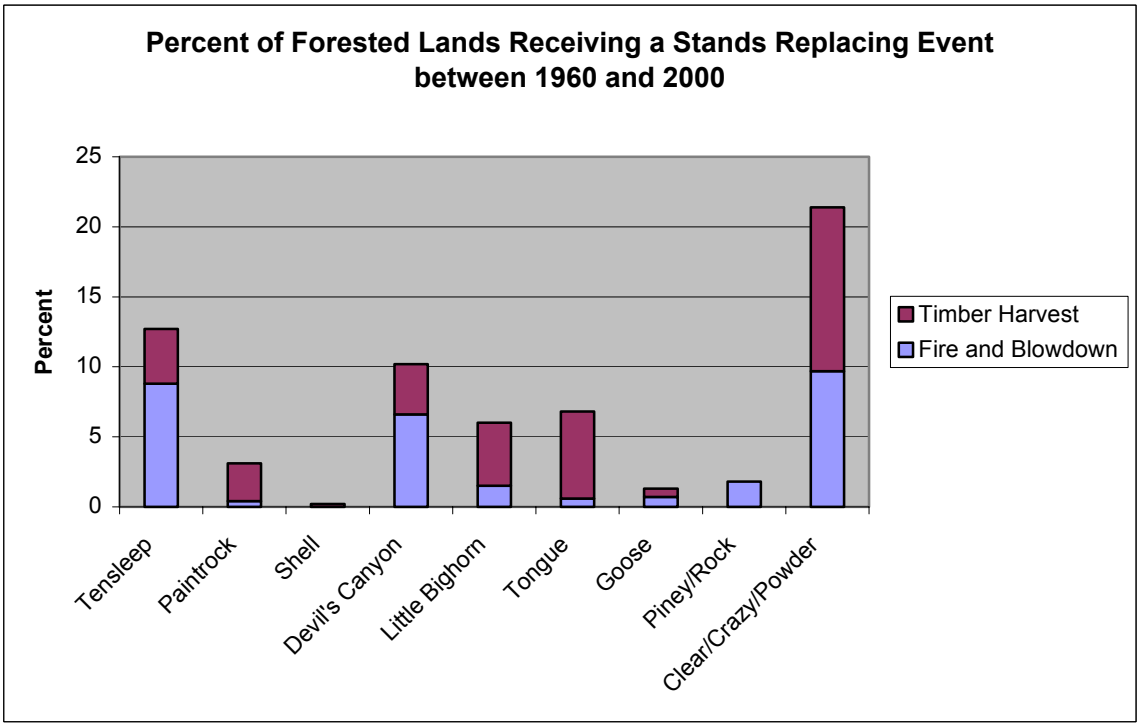


Figure 4. Percent of All Forested Lands that Received a Stand Replacing Event, 1960-2000



Exotic Species

- Forest-wide issue of non-native grass/forb seed mix for revegetation and erosion control.
- Fish: Eastern Brook trout, brown trout, golden trout, and rainbow trout are popular fishing species, but are not native to the Bighorn NF. Mountain sucker and longnose dace are the only fish species thought to be native to the Powder River geographic area.
- There are four identified areas in our GIS database of Canadian thistle in this geographic area. There are more sites, primarily along roads and timber harvest landings, throughout the geographic area.

IV. Geology and Geomorphology

Table 3 shows the Landtype Associations (LTAs) within the assessment area. Landtype associations are general descriptions of local geology and topography[4]. A map of the LTAs is in the appendix.

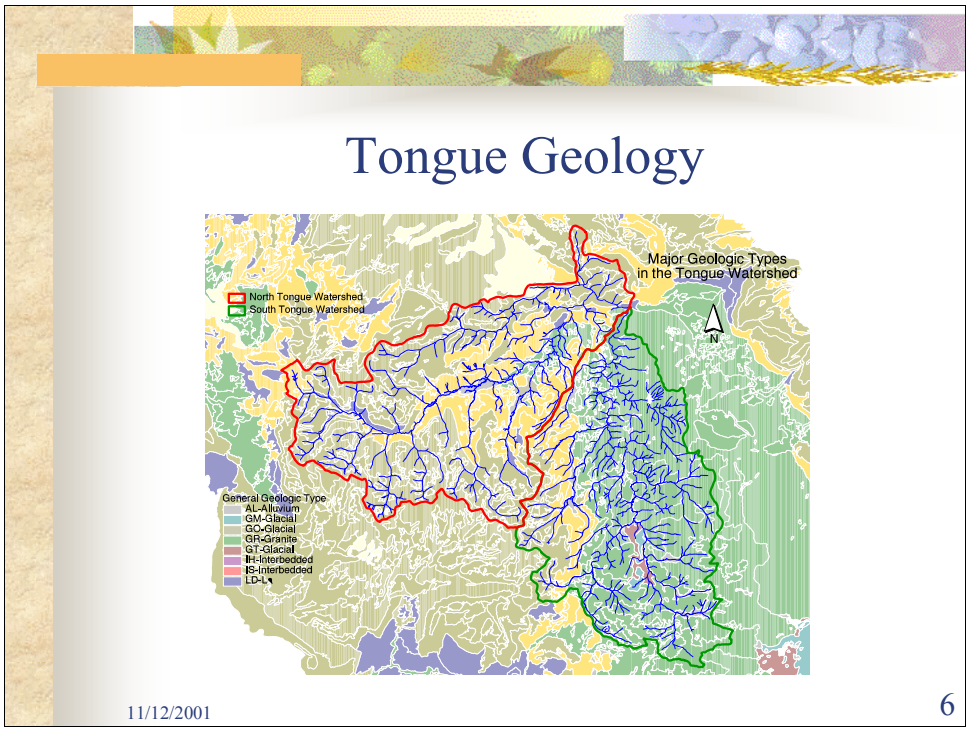
Table 3. Acres of Landtypes within Tongue Geographic Area

Landtype Description	Acres	% of total
Glacial cirquelands	0	0%
Alpine mountain slopes and ridges	4,597	3%
Glacial/tertiary terrace deposits	1,826	1%
Granitic mountain slopes, gentle	67,004	38%
Granitic mountain slopes, steep	5,328	3%
Granitic breaklands	3,868	2%
Sedimentary breaklands	19,594	11%
Sedimentary mountain slopes, limestone/dolomite	41,705	24%
Sedimentary mountain slopes, shale/sandstone	29,956	17%
Landslide colluvial deposits	3,190	2%
Unclassified	0	0%
TOTALS:	**177,068**	**101**

Overall, the geology of the Tongue geographic area is evenly split between limestone (41%) and granite (43%). However, when each watershed is evaluated individually, it is found that 78% of the South Tongue watershed is granite and 63% of the North Tongue is limestone. The differences in geology play a significant role in how aquatic and soil resources are distributed within the analysis area. A map of the geologies found in the analysis area is given in Figure 5.

[4] Landtype associations are groupings of landtypes or subdivisions of subsections based upon similarities in geomorphic process, geologic rock types, soil complexes, stream types, lakes, wetlands, and plant association vegetation communities. Names are often derived from geomorphic history and vegetation community. Avers, et al, 1993. See also Table 3, Chapter 1, for hierarchical location of landtype associations.

Figure 5. Geology of the Tongue Geographic Area



The northern Bighorn Mountains were formed 40 to 70 million years ago. Shale and limestone overlie most of the granite in this portion of the Forest. In the Dry Fork, limestone, dolomite, shale, and sandstone beds overly the thick carbonate formations (dolomite and limestone) that predominate in this area. Shale, sandstone, conglomerate and limestone beds underlie the carbonate formations. Faulting has occurred throughout the corridor.

The terrain and topography within and adjacent to the Tongue River and its tributaries is varied. Sheer canyon walls approximately 1,000 feet high are present along the lower corridor of the main channel below the junction of the North and South Tongue Rivers. Above the junction, the topography becomes much gentler. Wide valleys and broad floodplains are typical of the North Tongue watershed. Whereas, narrow valleys and highly dissected topography is typical in the South Tongue. These differences are a direct result in the type of geology that exists within each watershed.

The South Tongue watershed is dominated by granitic parent material while the North Tongue is representative of a high-elevation, montane watershed originating from the Madison limestone formation of the central Rocky Mountains. The Madison limestone formation comprises a large segment of the underlying geology of the North Tongue watershed and is exposed at numerous sites. Table 4 shows the specific geologies within the North and South Tongue watersheds.

Table 4. Geology of North and South Tongue Watersheds

Geology	South Tongue Watershed		North Tongue Watershed	
	Acres	%	Acres	%
Alluvium (AL)	0	0	1,394	2
Glacial (GO)	1,212	2	517	1
Granite (GR)	39,938	78	2,617	4
Landslide (LD)	0	0	1,536	3
Limestone (LS)	4,647	9	36,766	63
Sandstone (SS)	0	0	172	1
Mixed Sedimentary (SX)	5,416	11	15,206	26
TOTALS[5]	**51,213**	**100%**	**58,208**	**100%**

Geologic Hazards

The landslide map used in this analysis was created from 1:24,000 scale maps obtained from the Wyoming State Geological Survey office in Laramie, WY. Within the Tongue geographic area there are 11,353 acres of soils prone to landslides. The areas subject to slides are widely distributed in small units throughout the geographic area. Most of the landslide prone lands are located on limestone geologies.

Table 5. Landslide Prone Acres in Analysis Area

Geographic Area Name	Acres of Soils Prone to Landslides
Tongue Geographic Area	11,353

Erodibility

There are approximately 16,818 acres of soils within the Tongue geographic area classified as having a severe risk for erosion. Ground disturbing activities on these soils would increase the risk of generating erosion from these areas.

Table 6. Acres of Erodible Geology within Tongue Geographic Area

Geographic Area Name	Acres of Erodible Geology
Tongue Geographic Area	16,818

Mineral resources

A detailed minerals report for this area does not exist at this time. Minerals information for this area will be incorporated into the Forest-wide assessment.

Hydrologic Disturbance factors

This topic is relevant at the Forest-scale and is discussed in the Forest-wide assessment.

[5] These watershed acres may vary from the official watershed acres for the North and South Tongue watersheds due to differences in GIS analysis. However, the percent area in each geology will remain the same.

V. Soils and Topography

Soils on this part of the Forest are predominately formed in colluvial material resulting from erosion. Because carbonate rock is the most common rock exposed in the geographic area, most of the soils are basic and high in nutrients. Some granite and shale derived soils, with less fertility, occur in certain areas. Rock outcrops, including escarpments, canyon wall, and mountain peaks in the geographic area, are exposed to the effects of weathering, which causes fragments of rock to break from the outcrops. These fragments generally move down slope at a slow rate that is occasionally punctuated by a sudden downward movement, a landslide. Results of a soil survey of the Forest reveals a variety of soils types associated with colluvial material derived from rock outcrops. Interpretation of aerial photographs has reveled a number of potential landslide areas within the lower Tongue River geographic area.

Table 7 shows the soil types that occur in the Tongue geographic area and the amount of the analysis area comprised of each soil type. A description of each soil type can be found in the Project File. Forage production is displayed in Table 7 as a way to display the natural range of soil productivity within the analysis area (Nesser, 1976).

Table 7. Acres of Various Soil Types within Geographic Area

Soil Identification Number[6]	Acres	Productivity as Measured by Forage Production (#/acre)
10	24,089	500-700
11	10,919	500-700
12	0	600-800
13	0	Na
14	21,260	500-700
15	8,787	500-1,800
16	4,811	3,000-3,500
17	1,748	
18	517	1,500-1,800
19 A and B	1,212	500-700
21	631	1,500-1,800
22	1,768	1,200-1,700
23	0	1,500-1,800
24	832	1,600-2,400
25	7,615	1,500-1,800
26	1,175	600-1700
27	13,330	1,600-2,400
29	15,002	1,600-2,400
30	1,752	1,600-2,400
31	3,857	500-700
32	4,186	500-700
33	2,715	600-800
36	0	500-800
37	0	Na
38	0	500-700
39	0	600-1,700
40	0	500-700

[6] Descriptions of soil types and their management interpretations can be found in "Soil Survey of Bighorn National Forest, Wyoming". U.S.D.A. Forest Service, 1986.

Soil Identification Number[6]	Acres	Productivity as Measured by Forage Production (#/acre)
41 A and B	0	1,500-1,800
43	0	500-700
Water	40	Na

Erosional processes

This topic is relevant at the Forest-scale and is discussed in the Forest-wide assessment.

Range of variability in soil conditions

This topic is relevant at the Forest-scale and is discussed in the Forest-wide assessment.

Risk to soil resources including soil loss or compaction

This topic is relevant at the Forest-scale and is discussed in the Forest-wide assessment.

VI. Hydrology and Water Quality

The Tongue River forms at the junction of the North and South Tongue Rivers in the Bighorn Mountains. The major tributaries of the Tongue River include Little Tongue at Dayton, Smith Creek, Columbus Creek, Wolf Creek, and Five-Mile Creek. These tributaries have their source areas on the Forest, but may not constitute a significant portion of the overall geographic area on National Forest System lands. Table 8 lists the major watersheds within the planning area.

Table 8. Major 6th field watershed data within Planning Area

6th Field Watershed Name	6th Field Watershed Number	Perennial Stream Miles	Intermittent Stream Miles	FS WS Acres	Other WS Acres	Total WS Acres
North Tongue	100901010201	75	120	58,246	125	58,371
South Tongue	100901010202	77	149	54,440	460	54,900
Lower Tongue	100901010203	27	47	17,676	1,055	18,731
Little Tongue	100901010204	21	37	13,734	1,129	14,863
Wolf Creek	100901010205	36	57	22,688	0	22,688
Tongue at Dayton	100901010206	14	31	10,129	0	10,129
Totals:		**250**	**441**	**17,6913**	**2,769**	**179,682**

Water Quality and Water Uses

The river flows east off the Forest into an area called the Tongue River canyon. Access to the river in the canyon is limited to a pack trail and recreation is the primary land use. It is in this reach that the Wyoming Game and Fish Department (WGFD) has classified the river as being a Class 1 trout fishery. This classification means that the Tongue River contains a fishery of statewide significance or importance.

An in-stream flow water right was issued for the Tongue River in 1990. This is only the third stream in Wyoming at the time approved for an instream flow water right. The instream flow right is for 60 cubic feet per second (cfs) from July through March, 80 cfs in April, and 180 cfs during May and June. There are no dams on the mainstem of the Tongue River from its headwaters to the Wyoming state line where it enters the state of Montana.

Water quality concerns have emerged over the years in the segment of the Tongue River from the Forest boundary to the town of Ranchester. Concerns were related to suspect water quality deterioration from sediment, nutrient, and bacterial inputs to the Tongue River and its tributaries. Public health and safety concerns surfaced because the towns of Dayton and Ranchester rely on the Tongue River for their domestic water supplies. The town of Ranchester received complaints from residents regarding turbidity and odor. The Ranchester water treatment plant has shut down on occasion when the facility was unable to meet treatment standards. Moreover, the Tongue River is a Class 1 coldwater trout fishery near the Bighorn National Forest boundary. This classification indicates that there is a premium trout fishery of national or statewide importance. The quality of the fishery has been shown to decline towards the town of Ranchester suggesting a decline in water quality.

In 1996, the Wyoming Department of Environmental Quality listed the Tongue River in its 305(b) report indicating that the river was not fully supporting its beneficial uses. In 1996, the 305(b) report listed the segment of Tongue River below the Forest boundary as being threatened due to declining water quality. The causes responsible for this finding were listed as siltation and nutrient loading based on information provided by the Wyoming Game and Fish Department, and the U.S. Geological Survey. The sources of contamination were identified as being range and pasture lands.

Water quality in the Tongue River as it flows from National Forest System lands is considered good to excellent with few exceptions. Land use in the Bighorn National Forest produced no significant effects on water quality and stream biological conditions in the Tongue River or its tributaries. These statements come from a report titled, "*Tongue River Watershed Assessment 205j Final Report 1996-1999*". The report was implemented to determine the exact condition of water quality in the Tongue River system. The Sheridan County Conservation District (SCCD) in partnership with the Natural Resources Conservation Service (NRCS) funded the project. The project was not only implemented for water quality concerns, but also because of the high value for resources in the watershed and to continue to address voluntary conservation and resource issues as part of an integrated conservation program.

Table 9. Wyoming Surface Water Quality Classifications (1998) and Domestic Water Users

Watershed	Wyoming Surface Water Quality Class	Tributaries	Wyoming Surface Water Quality Class	Community Water System being Served
Tongue River	1 (on National Forest)			City of Dayton City of Ranchester
		North Tongue	1	
		South Tongue	1	
		Wolf Creek	2AB	Eaton's Dude Ranch

All streams within the analysis area (except Wolf Creek which is 2AB) are classified as Class 1. The Wyoming Department of Environmental Quality (WDEQ) classifies the North and South Tongue Rivers as Class 1 rivers (WDEQ, 2000). This classification indicates that these streams are among the highest quality water bodies in Wyoming. The Tongue watershed is the only Class 1 watershed on the Bighorn National Forest. The WDEQ stream classification changes to Class 2 below the junction of the North and South Tongue Rivers.

Class 1, Outstanding Waters. Class 1 waters are those surface waters in which no further water quality degradation by point source discharges other than from dams will be allowed. Nonpoint sources of pollution shall be controlled through implementation of appropriate best management practices (BMP's). The water quality and physical and biological integrity, which existed on the water at the time of designation, will be maintained and protected.

Class 2, Fisheries and Drinking Waters. Class 2 waters are waters that are known to support fish or drinking water supplies or where those uses are attainable. Class 2 waters may be perennial, intermittent or ephemeral and are protected for the uses indicated in each sub-category. There are four sub-categories of Class 2 waters. Class 2AB waters are those known to support game fish populations or spawning and nursery areas at least seasonally and all their perennial tributaries and adjacent wetlands and where a game fishery and drinking water use is otherwise attainable.

In 2000, the State conducted a review of all watersheds within the State to determine whether or not they are meeting the designated beneficial uses (i.e., fisheries, recreational use, etc.). The results of that review can be found in the document titled, "Wyoming 2000 305(b) State Water Quality Assessment Report". Table 10 summarizes the watersheds within this analysis area listed in the State 305(b) report.

Table 10. Water Quality Impaired Watersheds (2000)

Watershed	Listed on 2000 State 305(b) Report?	Type of Listing (Impaired or Threatened)	Reason for Listing and Location of Impairment
Tongue River (on National Forest)	No		The North Fork of Tongue River has been removed from the state impaired list due to the TMDL development for chlorine (TRC).

Human Impacts Upon Water Quality

Influence of Timber Harvesting upon Water Quality

Timber harvest activities are one of the major land management activities within the analysis area. The mechanical processes involved in timber harvest and associated road construction, in conjunction with natural conditions, influence the level of disturbance within watersheds. Negative effects tend to increase when activities occur on environmentally sensitive terrain with steep slopes composed of highly erodible soils that are subject to high climatic stresses.

Soil and site disturbance that inevitably occur during timber harvest activities are often responsible for increased rates of erosion and sedimentation, modification and destruction of terrestrial and aquatic habitats, changes in water quality and quantity, and perturbation of nutrient cycles within aquatic ecosystems. Physical changes affect runoff events, bank stability, sediment supply, large woody debris retention, and energy relationships involving temperature. All of these changes can eventually culminate in the loss of biodiversity within a watershed.

Increased delivery of sediments, especially fine sediments, is usually associated with timber harvesting and road construction. As the deposition of fine sediments in salmonid spawning habitat increase, mortality of embryos, alevens, and fry rises. Erosion potential is greatly increased by reduction in vegetation, compaction of soils, and disruption of natural surface and subsurface drainage patterns. Generally, logged slopes contribute sediment to streams based on the amount of bare compacted soils that are exposed to rainfall and runoff. Slope steepness and proximity to channels determine the rate of sediment delivery.

Research by Troendle, et al (1998), shows that when approximately 24% or more of the basal area of a watershed is removed, peak flows (instantaneous maximum flow or maximum mean daily flow) were not significantly increased. However, the duration of the higher, near bankfull discharges were extended.

Table 11 gives the acres of treatment followed by the equivalent clearcut acres for that treatment. An equivalent clearcut acre is roughly equal to the basal area removal for a given harvest type. For example, a shelterwood prep-cut removes approximately 33% of the basal area in a treated stand. The ECA for that prescription is 0.33.

Table 11. Equivalent Clearcut Acres for Tongue Geographic Area

Harvest Type	Equivalent Clearcut Multiplier	1950's	1960's	1970's	1980's	1990's	2000	Totals
Clearcut								
(acres)	1.00		3559	1212	406	712		5889
(ECA)			3559	1212	406	712		**5889**
Shelterwood: Prep Cut	0.33							
(acres)			64	1102	3103	61		4330
(ECA)			21	364	1024	20		**1429**
Shelterwood: Seed Cut	0.33							
(acres)						558		558
(ECA)						184		**184**
Shelterwood: Overstory Removal	1.00							
(acres)				60		844		904
(ECA)				60		844		**904**
Seed Tree	0.85							
(acres)								
(ECA)								
Selection	0.35							
(acres)					98	68		166
(ECA)					34	24		**58**
Commercial Thin	0.35							
(acres)				12	1208	98		1318
(ECA)				4	423	34		**461**
Sanitation/Salvage	0.35							
(acres)				60	20	881		961
(ECA)				21	7	308		**336**
Pre-commercial Thin	0.20							
(acres)					2327	855		3182
(ECA)					465	171		**636**
Aspen Clearcut	1.00							
(acres)					2	5		
(ECA)					2	5		
Fire	1.00							
(acres)		91				651		742
(ECA)		91				651		**742**
Blowdown	1.00							
(acres)						1200		1200
(ECA)						1200		**1200**
TOTAL ECA								**11839**
% of Area[7]								**7%**

As shown in Table 11, approximately 7% of the geographic area is in an ECA condition. In reality, this number would be somewhat less than 7% due to vegetation recovery following fire or timber removal. However, given this worst-case scenario, timber management combined with natural wildfire has probably not exceeded the range of variability in vegetation removal in this geographic area.

[7] This number does not account for vegetation recovery over time. Following fire or timber harvest, trees will reestablish themselves on a site and the ECA for that activity will approach zero. Therefore, the ECA's for this watershed will probably be somewhat less than suggested by this table. Also, roads were not included in this table at this time. Roads add approximately 4 acres of ECA per mile.

Influence of Roads upon Water Quality

Roads contribute more sediment to streams than any other land management activity, but most land management activities such as mining, timber harvest, grazing, recreation, and water diversions are dependant on roads. The majority of sediment from timber harvest activities is related to roads and road construction and associated increased erosion rates. Serious degradation of fish habitat has been shown to result from poorly planned, designed, located, constructed, or maintained roads.

Road/stream crossings can also be a major source of sediment to streams resulting from channel fill around culverts and subsequent road crossing failures. Plugged culverts and fill slope failures are frequent and often lead to catastrophic increases in stream channel sediment, especially on old abandoned or unmaintained roads. Unnatural channel widths, slope, and streambed form occur upstream and downstream of stream crossings, and these alterations in channel morphology may persist for long periods of time. Channelized stream sections resulting from rip-rapping of roads adjacent to stream channels are directly affected by sediment from side casting, snow removal, and road grading; such activities can trigger fill slope erosions and failure. Because improper culverts can reduce or eliminate fish passage, road crossings are a common migration barrier to fishes (Figure 6).

Figure 6. Stream crossing improvement needs in the Tongue Geographic Area

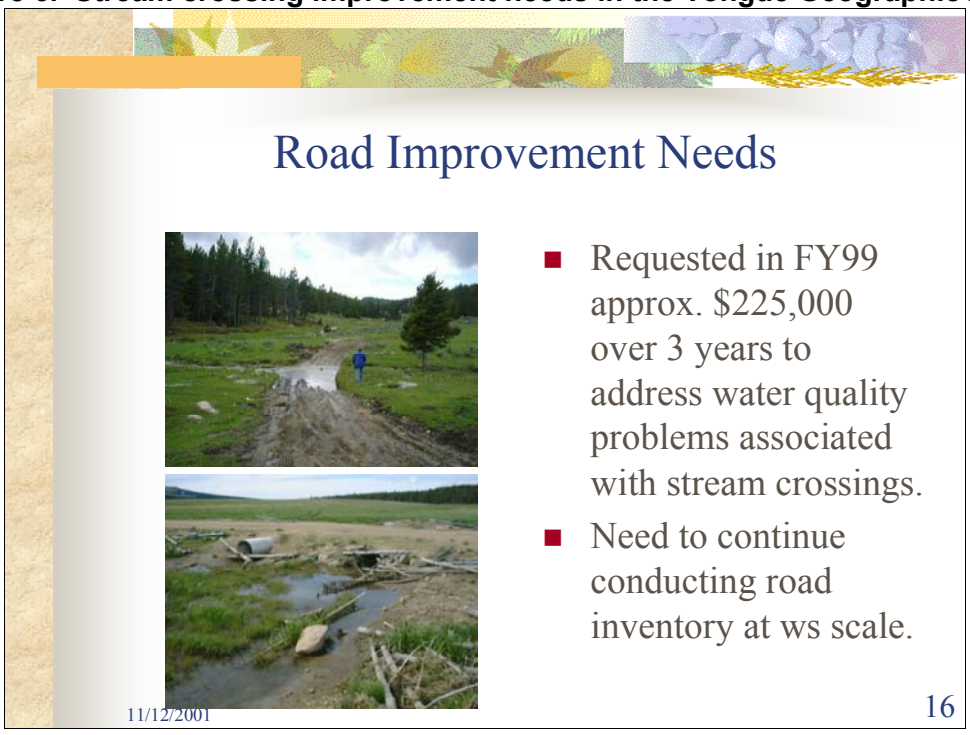


Table 12. Number of Stream Crossings in Planning Area

Watershed	No. of Stream Crossings	No. of Stream Crossings/Square Mile
North Tongue	85	0.93
South Tongue	187	2.20
Wolf Creek	25	0.71

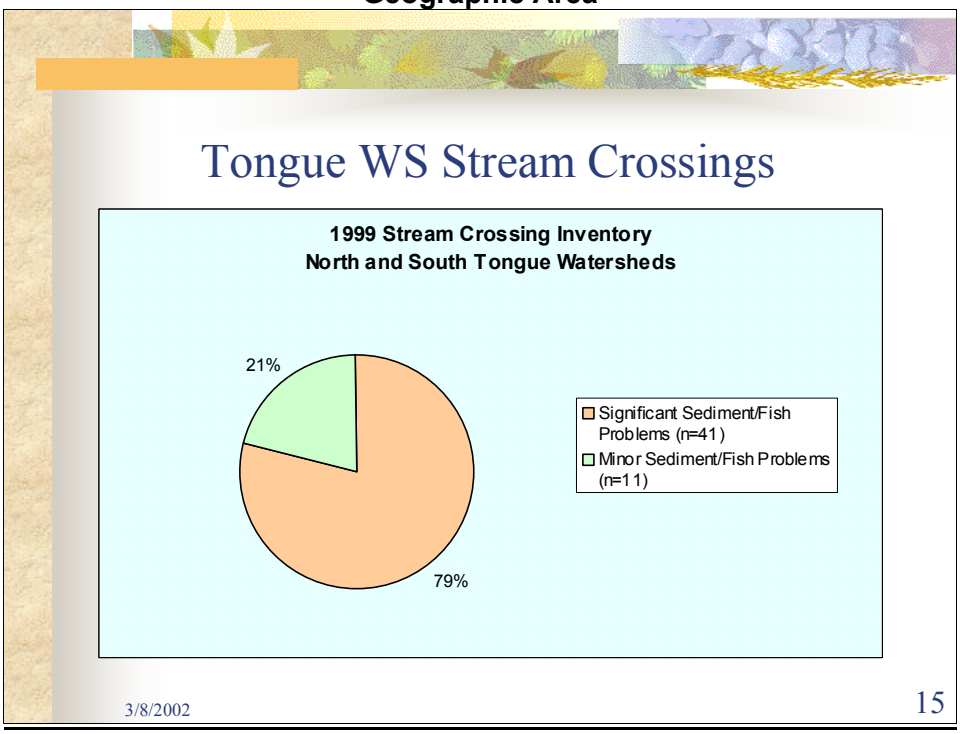
Roads in the analysis area directly affect natural sediment and hydrologic regimes by altering stream flow, sediment loading, sediment transport and deposition, channel morphology, channel stability, substrate composition, stream temperatures, water quality, and riparian conditions within a watershed. Road related mass movements can continue for decades after the roads have been constructed. Such habitat alterations can adversely affect all life-stages of fishes, including migration, spawning, incubation, emergence, and rearing.

Field inventories have shown that the amount of watershed risk presented by roads in the analysis area is directly related to maintenance level. The lower maintenance level roads tend to be more susceptible to yearly input of sediment into nearby streams. Table 13 displays the existing miles of road by maintenance level in the analysis area. This number will be used to compare watersheds at highest risk for road related watershed impacts.

Table 13. Miles of Forest Service Road by Maintenance Level

Maintenance Level	Miles of road within the Geographic Area	Overall Condition and Watershed Risk
Unclassified	46	In the watershed, roads in this category are generally either user-created or abandoned system roads (50/50). The level of watershed risk depends upon the treatments used to reclaim them. They tend to be used seasonally to access recreation areas. No maintenance occurs on these roads. Watershed impacts can occur when these roads are near water bodies. However, limited use reduces the risk to water quality.
Level 1	124	These roads are generally not open to the public. They are closed except for administrative purposes. Watershed impacts tend to vary with the amount of use and the effectiveness of erosion control measures.
Level 2	153	These roads tend to be native surface roads with poor drainage design. During wet seasons, rutting frequently occurs. Stream crossings are generally a source of sediment. These roads pose the highest risk to water quality due to their frequent use, number of stream crossings, and low standard design. However, road maintenance is beginning to catch up on the tremendous backlog of improvement needs in this area.
Level 3	16	These roads are generally designed with good road drainage and maintained on a regular basis. These roads tend to be in-sloped with a ditch and have a gravel surface. They usually do not pose a serious threat to water quality.

Figure 7. Stream crossings contributing to degraded water quality in the Tongue Geographic Area



Influence of General Recreational Activities upon Water Quality

This topic is relevant at the Forest-scale and is discussed in the Forest-wide assessment.

Reservoirs and Impoundments

There are no reservoirs or impoundments within this geographic area.

Wetlands/Riparian Areas

Table 14 shows the acres of riparian area within the geographic area, and a map of the riparian areas is in the appendix. Riparian areas are defined in management prescription area 9A of the 1985 Forest Plan, page III-198:

> "The aquatic ecosystem, the riparian ecosystem (characterized by distinct vegetation), and adjacent ecosystems that remain within approximately 100 ft. measure horizontally from both edges of all perennial streams and from the shores of lakes and other still waters bodies."

Table 14. Acres of Riparian within Geographic Area

6th Field Watershed Name	6th Field Watershed Number	Acres of Riparian	Miles of Road within Riparian
North Tongue	100901010201	5289	23.8
South Tongue	100901010202	7807	25.5
Wolf Creek	100901010205	2219	1.06
	Totals:	**15,315**	**50.36**

At the time of the 1985 Forest Plan, only a few of the larger riparian areas were mapped. Since then, the riparian mapping project defined areas of riparian vegetation, and Geographic Information Systems (GIS) were developed, making the mapping of riparian areas feasible. The riparian mapping project on the Bighorn was completed in about 1995. The project consisted of using 1992 color infrared, 1:24,000 scale, aerial photography to map riparian areas based upon a combination of the riparian vegetation and the stream course geomorphology and topography.

Riparian vegetation has a moderate influence on water yield due to evapotranspiration rates associated with riparian species. Since evapotranspiration rates are highest during periods of highest runoff, the effect of riparian vegetation on the timing of water yield is only moderate. Riparian vegetation is extremely important for control of sediment from upslope sources during high runoff/surface erosion periods. Riparian vegetation is also critical for the stability of lower gradient stream reaches.

VII. Aquatic Species and Their Habitat

Aquatic Species Habitats

Streams in the analysis area support a diverse assemblage of fish species. Based on electro-fishing evaluations, conducted by the Wyoming Game and Fish Department (WGFD) and BNF personnel, between 1983 and 2000, brook trout (BKT), brown trout (BNT), rainbow trout (RBT), and cutthroat trout (CUT) are present in the analysis area (Table 15), depicts species distribution, stream miles, and miles of occupied habitat within the analysis area.

Table 15. Species presence, abundance, and miles occupied in Tongue Geographic Area

Watersheds/Sub-Watersheds	Species Present (Abundance*)	Miles of occupied habitat	WGFD Stream Class
Lower North Tongue River	BKT (2) RBT (2)	7.0	1
Columbus Creek	BKT (3)	5.0	3
Amsden Creek	BKT (3)	4.0	3
Smith Creek	BKT(1)	1.0	3
Sheep Creek	BKT (3)	5.7	3
Horse Creek	RBT (1) BKT (1)	2.0	3
Cutler Creek	RBT (1)	1.0	3
Tie Creek	RBT (1)	1.0	3
Upper North Tongue River	BKT (2) RBT (1) SRC (2)	18.0	2
Fool Creek	YSC (1) RBT (1)	8.7	3
Little Willow Creek	BKT (3)	2.5	3
Big Willow Ceek	BKT (2) RBT (2) SRC (1)	5.8	3
Bull Creek	BKT (2) SRC (2)	4.2	3
Hideout Creek	No Data	-	4
Spring Creek	No Data	-	4
Hidden Tepee Creek	No Data	-	4
Trail Creek	No Data	-	4
Fishhook Creek	No Data	-	4
Wallrock Creek	No Data	-	4
Pole Creek	No Data	-	4
Little Tongue River	BKT (1)	6.0	3
Wolf Creek	BKT (2)	6.7	3
S Fork Little Tongue	YSC below FS boundary	1.0	3
South Tongue River	BKT (3) BNT (2) RBT (2)	15.0	2
Johnson Creek	No Data	-	5
Marcum Creek	BKT (1)	3.0	4
Prune Creek (below Sibley)	BKT (2) BNT (2) RBT (2)	2.5	3
Prune Creek (above Sibley)	BKT (2) SRC (1)	3.0	4
Sheeley Creek	BKT (2) BNT (1) RBT (1)	1.5	4
Owen Creek	BKT (2) BNT (2) RBT (2)	4.0	3
Dry Owen Creek	No Data	-	5
Copper Creek	BKT (3)	3.0	4
Sucker Creek	BKT (3) BNT (1)	5.2	3

Watersheds/Sub-Watersheds	Species Present (Abundance*)	Miles of occupied habitat	WGFD Stream Class
Bonanza Creek	No Data	-	4
W. Fork S. Tongue River	BKT (3) BNT (2)	6.0	3
Compartment Creek	BKT (2)	1.5	4
Prospect Creek	BKT (2) BNT (1)	2.2	3
Bruce Creek	BKT (2)	1.5	4
E. Fork S. Tongue	BKT (3) BNT (1)	7.2	3
Graves Creek	BKT (2)	2.0	4
Mohawk Creek	BKT (2)	2.0	5
Woodchuck Creek	BKT (2)	1.5	4

Species Codes: RBT = rainbow trout, BKT = brook trout, BNT = brown trout, **YCT** = Yellowstone cutthroat trout SRC= Snake River Cutthroat;
*Abundance Codes: 1 = rare, 2 = common, 3 = abundant.

The Tongue River drainage has a diverse fish assemblage and offers some unique angling opportunities. Streams in the headwaters contain Snake River cutthroat, rainbow, brown and brook trout. Fisheries in the North and South Tongue drainages, with the exception of the upper end of the North Tongue and the entire length of Bull Creek, are regulated under Wyoming statewide fishing regulations, allowing 6 trout per day. The present regulation for the upper Tongue River, including all tributaries, from the mouth of Bull Creek upstream including Bull Creek is that all trout (except brook trout) must be released; fishing with flies and lures only.

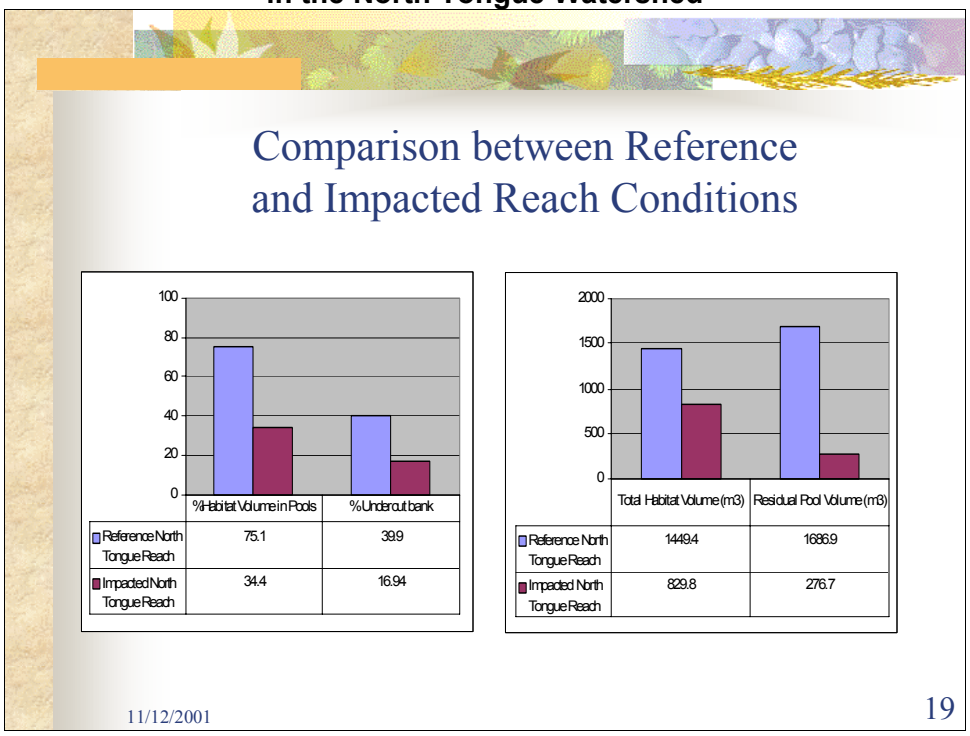
Sensitive Species

The Tongue River Basin is the historic eastern edge of pre - Columbian Yellowstone Cutthroat trout distribution (Behnke 1992). Although the Tongue River falls within the historic range of Yellowstone cutthroat trout (Varley and Gresswell, 1988), there is little evidence that native populations exist in the analysis area today. Now the vast majority of sport fishing in the basin is for introduced Salmonid species.

Portions of the Tongue River drainage have been targeted for recovery of Yellowstone cutthroat trout through stocking of fry and advance fingerling fish. From the mid- 1950's to the present, fisheries management of the upper North Tongue River included annual stocking of Snake River Cutthroat. Bull Creek was periodically stocked with Snake River Cutthroat fingerlings from 1955 to 1985 and has been annually stocked with Snake River Cutthroat since 1985. Fool Creek has been stocked with Yellowstone Cutthroat trout since 1998. There has been little evidence of natural reproduction of stocked fish in these drainages.

A potentially endemic population of Yellowstone Cutthroat trout was discovered in the South Fork of the Little Tongue River in the summer of 2000 below the National Forest Boundary. These fish are currently being analyzed for genetic purity and further inventory is planned in 2001 to determine if this population is within the analysis area.
In the Cedar creek drainage there is a population of genetically pure Yellowstone Cutthroat trout downstream from the analysis area boundary.

Figure 8. Comparison between impacted and reference reaches in the North Tongue Watershed



Habitat Information

The Forest has collected aquatic habitat and channel morphology data for the entire Tongue geographic area. However, the information is quite detailed and not suited for this scale analysis. The watersheds with reach-level habitat and channel morphology data are:

- Lower North Tongue River
- Upper North Tongue River
- North Tongue Tributaries (Fool Creek, Little Willow Creek, Big Willow Creek, Bull Creek, and Pole Creek
- Little Tongue River
- South Tongue River
- South Tongue Rive Tributaries (Marcum Creek, Owen Creek, Copper Creek, Sucker Creek
- West Fork South Tongue River (Prospect Creek, Bruce Creek)
- East Fork South Tongue River (Graves Creek, Mohawk Creek, Woodchuck Creek)

Information Inventory Techniques

A variety of inventory techniques and tools were used to evaluate existing soil and aquatic conditions in watersheds related to the analysis area. The description of the affected environment is based on a variety of surveys conducted over a number of years. Mapping inventories, quantitative stream and aquatic habitat surveys, and qualitative field assessments all have played a part in determining the existing condition. Stream reaches were assessed relative to their sensitivity and susceptibility to management impacts. Stream channel type, riparian vegetation, stream condition, fish habitat information, and fish population estimates were used to describe the condition of aquatic and riparian habitat Multiple monitoring techniques were used at numerous

locations on the North and South Tongue rivers and their tributaries. Quantitative stream and aquatic habitat surveys are the most powerful tool employed, followed by qualitative field assessments.

Presented below is a summary of the data collected and the tools used to assess this information (Table 16). Each category will be discussed in greater detail in the section following the table.

Table 16. Soils and aquatic resource data collected in the Tongue Geographic Area (up to 2000)

Water Resource Issue	Item Sampled	Date Collected or Studied	Location of Inventory	Person(s) Responsible	Analysis Tool Used
Soils/Slope Stability	Slope Stability	1986	All watersheds	BIGHORN NATIONAL FOREST Soil Scientist	Soil Survey of Bighorn N.F., Wy (Nesser 1986)
	Landslide Hazards	1994	All watersheds	Geological Survey of Wyoming	Landslide Hazard Maps for the BIGHORN NATIONAL FOREST (Jim Case 1994)
Riparian Area/ Wetlands	BIGHORN NATIONAL FOREST Riparian Classification	1999	All watersheds	IDT	Classification of Riparian Communities on the Bighorn N.F. (Girard et al 1997)
	Wetlands	1997	All watersheds	IDT	National Wetlands Inventory (1994)
Channel Morphology	Rosgen Stream Type	1999	All watersheds	IRI data	Rosgen Stream Classification (Rosgen 1985) R1/R4 Fish Hab Inventory Cowfish (1986)
Stream Bottom Composition	% Fine Sediment	1997	All watersheds	BHNF Field Crew	T-Walk Inventory R1/R4 Fish Hab Inventory
Water Quality	Sediment Sources	1991; 1998	Roads, Crossings, and Development within analysis area	BHNF Field Crew IDT, Nesser	Visual survey of potential and existing sediment sources within the analysis area
Watershed Health	Vulnerability, Geomorphic Integrity, Water Quality	1998	All watersheds	BHNF Hydrologist	Inland West Water Initiative
Fisheries	Species, density, location	1980 -2000	All Watersheds	State of WY; UW Student; BHNF Fish Bio.	WGFD Fish data UW Phd Thesis Fish population estimates using electro-fishing gear.

Classification of Riparian Communities on the BNF – The primary use of this riparian classification is to determine if Forest Plan Standards and Guidelines are being met Currently the BNF Plan states that, “all riparian areas should be maintained in a late mid-seral condition” (USFS 1985). Using this classification (Girard 1997), it is possible to map riparian areas by ecological and community types and determine the seral condition of a riparian community. One of the primary purposes of this study is to determine what late mid-seral vegetation is for the variety of riparian sites found on the Bighorn National Forest. Riparian areas that were inventoried during the 1999 field season targeted sites within the vicinity of critical aquatic habitat. See following explanation of critical aquatic habitat.

COWFISH Habitat Suitability Model – Cowfish was designed to assist resource specialists in analyzing the condition of the riparian environment in relation to the past and current livestock grazing management and to estimate the compatibility of the grazing with associated aquatic resources (USFS 1986).

Critical Aquatic Habitat (Reaches) – Critical habitats in the Tongue River Analysis area are defined as:

(1) The specific areas within the geographic area occupied by native or introduced aquatic species on which are found physical and biological features essential to the conservation of those species, and that may require special management considerations or protection. Key habitat elements include: over-wintering, spawning, rearing, and feeding habitats.

(2) Specific areas outside the geographic area occupied by native or introduced aquatic species, when it is determined that such areas are essential for the conservation of those species. Such areas include stream reaches necessary to access particular habitats or connect populations to other key habitats.

The focus on conserving critical elements is clear from this definition. Habitats supporting the most productive, diverse, or otherwise critical populations provide the best opportunities for short-term persistence. They also provide the best opportunities for rehabilitation of more complete systems in the future. An emphasis on conservation in critical habitats does not necessarily mean land management activities cease. It does imply however, that any management must clearly minimize or eliminate risks that might compromise the ability of populations to maintain or improve their status over time.

Many streams in the analysis area flow through a series of low gradient meadows with relatively broad riparian areas. Steeper stream reaches, often flowing through forested corridors and steep canyons, connect the low gradient reaches. Channel stability in stream reaches is provided for by large rock, deep-rooted vegetation, and woody debris. In general, channels with these characteristics tend to not be easily affected by livestock grazing. In contrast, channel stability in stream reaches in riparian meadows is largely provided for by riparian vegetation in the form of root mass and density. Because livestock tend to concentrate in riparian meadows, channel stability and riparian characteristics in those meadows can be negatively affected. Concentrated livestock use can affect channel stability directly, by influencing the density and vigor of streamside vegetation, bank shear by hoof action, and indirectly by inducing channel downcutting and floodplain abandonment. Streams have not been surveyed along their entire length and data collection, for the most part, has been directed at areas of potentially critical stream reaches. (See map of critical reaches within the Tongue drainage in index)

General Aquatic Wildlife System (GAWS) – This inventory procedure has been used in the past as a basic survey for prescriptive planning of stream habitats and Forest Plan implementation. The survey uses a series of transects to measure habitat parameters and is intended for use where non-natural alteration of aquatic habitats is predicted. The objective of the survey is to provide information necessary to make land management recommendations (USFS 1986).

Integrated Resource Inventory (IRI) – Integrated Resource Inventory (IRI) is a Geographic Information System (GIS) to spatially locate, integrate, and describe water, land, and vegetation data (BNF 1999). IRI is composed of three distinct themes Common Water Unit (CWU), Common Land Unit (CLU), and Common Vegetation Unit (CVU). CWU is a system for organizing and storing basic watershed and water resource data. The riverine level includes delineation of watersheds and valley segments, and identification of some general watershed attributes. The

inventory on the BNF was accomplished primarily through aerial photograph interpretation, with some field verification. Valley segments are defined by channel gradient, valley shape, geologic material, channel pattern, and riparian vegetation. Valley segments stratify the stream network into functional components that define broad similarities in fluvial processes, sediment transport regimes, and riparian interactions.

Inland West Water Initiative (IWWI) – In 1998, Regional Foresters of four inland west regions began a process called IWWI. IWWI was initiated to help National Forests focus limited federal dollars on important watersheds and provide for the orderly management of all watersheds over time. Specific purposes of IWWI are to; construct accurate maps of all 6th field watersheds, estimate the probable status of watersheds and aquatic systems, locate watersheds and aquatic systems that are critical to long-term sustainability of western water resources, and identify damaged aquatic resources on USFS lands. The effort was completed on the BNF in 1998. Within the analysis area, the North and South Tongue drainages were evaluated. The results of the IWWI inventory indicated that both drainages had a "low" watershed geomorphic integrity. This low rating was given primarily because of the 303(d) reaches and the excessive sedimentation and stream bank instability that have been noted in the past, and the inherently sensitive nature of this watershed and the risks of degradation. It is important to qualify this rating with the fact that these ratings are preliminary and subject to verification with more detailed analysis. As noted, this watershed has improved substantially since grazing practices were modified and instream habitat restoration was initiated. The other sub watersheds in the analysis area had a "moderate" watershed geomorphic and water quality integrity rating. This rating was given primarily because of disturbance in isolated areas due to grazing.

R1/R4 Fish and Fish Habitat Standard Inventory Procedure – This inventory was designed to define the structure, pattern, and dimensions of fish habitat, describe species composition, distribution, and relative abundance of salmonid species, and facilitate the calculation of summary statistics for habitat descriptors (Overton et. al. 1997).

Rosgen Stream Classification – The Rosgen classification system is used to understand and predict responses of management decisions. The classification system is used to describe the complexities of river processes through interrelated variables that determine the dimension, pattern, and profile of the present day channel. The Rosgen classification is derived from field measurements of stream entrenchment, width-depth ratio, sinuosity, slope, and particle sizes. An arrangement of the morphological variables can be organized into a common description called a "stream type" (Rosgen 1996). Rosgen stream types range from steep and confined channels, that generally consist of step-pool and cascade-dominated streams (stream types A and Aa+), through moderate gradient and moderately confined step-pool channels (stream types B and G) to low gradient, unconfined pool and riffle dominated channels (stream types C, D, and E).

Thalweg Watershed Area Link (T-WALK) – T-Walk employs a systematic sampling of substrate conditions and thalweg depth to evaluate sediment impacts (Ohlander 1994). Substrate productivity and particle size distribution are quantitatively evaluated by assigning a Tarzwell Substrate Ratio (TSR) value to points along the thalweg. A pebble count procedure is used to describe particle size distribution of the substrate. Categorical data includes estimates of bank vegetation and root density, bank stability, channel geometry, macro-invertebrate populations, and storm runoff control.

Watershed Needs Inventory (WIN) – An analysis of forty watersheds on the Forest was conducted as part of the BNF Watershed Improvement Needs Inventory (WIN). Watersheds were investigated based primarily on BNF District recommendations and knowledge of personnel conducting the survey (Nesser 1992). Observations of watershed health included upland erosion, lack of sufficient healthy vegetative cover, stream bank stability, channel condition, and sediment

deposition. The T-WALK technique (Ohlander 1994) was also used as a tool in WIN. Each watershed was placed into one of the following three categories:

Type I: Exhibit serious signs of watershed disequilibrium such as unstable channels, excessive upland erosion, or loss of vegetative cover. These watersheds may need major changes in management and various improvement activities in order to stabilize and improve them.

Type II: Exhibit less serious signs of disequilibrium and can usually be improved through minor changes in management and or some improvement projects.

Type III: Generally stable watersheds that are in good condition and do not require management changes or improvement needs.

Key Reaches - We did not survey the entire length of each stream within the assessment area. Instead, we concentrated the assessment on key stream reaches. Many of the streams in the assessment area flow through a series of low gradient meadows with broad riparian areas. Steeper stream reaches, often flowing through forested corridors, connect the meadow reaches. Livestock tend to concentrate in the meadows and tend to use the steeper, forested reaches primarily for travel corridors. Stream stability in the steeper reaches is provided by large rock and large wood. These characteristics tend not to be affected by livestock grazing. In contrast, stability in meadow stream reaches is largely provided by vegetation and access to the floodplain. Riparian livestock grazing can affect stability directly, by influencing the density and vigor of streamside vegetation and bank shear by hoof action, and indirectly by inducing channel downcutting and floodplain abandonment. Because livestock use is concentrated in meadows and because livestock can significantly affect channel stability and riparian characteristics in meadow stream reaches, most key stream reaches were located in meadows.

Natural and human causes of change affecting aquatic life

This topic is relevant at the Forest-scale and is discussed in the Forest-wide assessment.

Influence Of Non-Native Fish Species Introductions

This topic is relevant at the Forest-scale and is discussed in the Forest-wide assessment.

Influence of Aquatic Habitat Fragmentation and Simplification

This topic is relevant at the Forest-scale and is discussed in the Forest-wide assessment.

VIII. Air Quality and Visibility

This topic is relevant at the Forest-scale and is discussed in the Forest-wide assessment.

IX. Climate

This topic is relevant at the Forest-scale and is discussed in the Forest-wide assessment.

X. Vegetation

Composition, distribution, and abundance of the major vegetation types and successional stages of forest and grassland systems

Figure 9 shows the major vegetation cover types that occur in the Tongue geographic area. Non-vegetation includes rock and bare areas.

Figure 9. Vegetation Cover Types in the Tongue area.

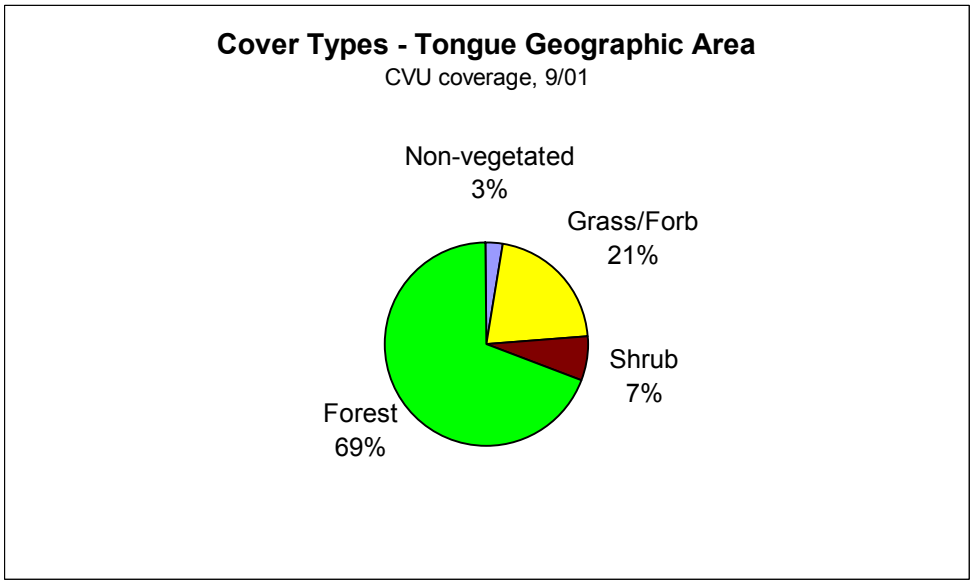
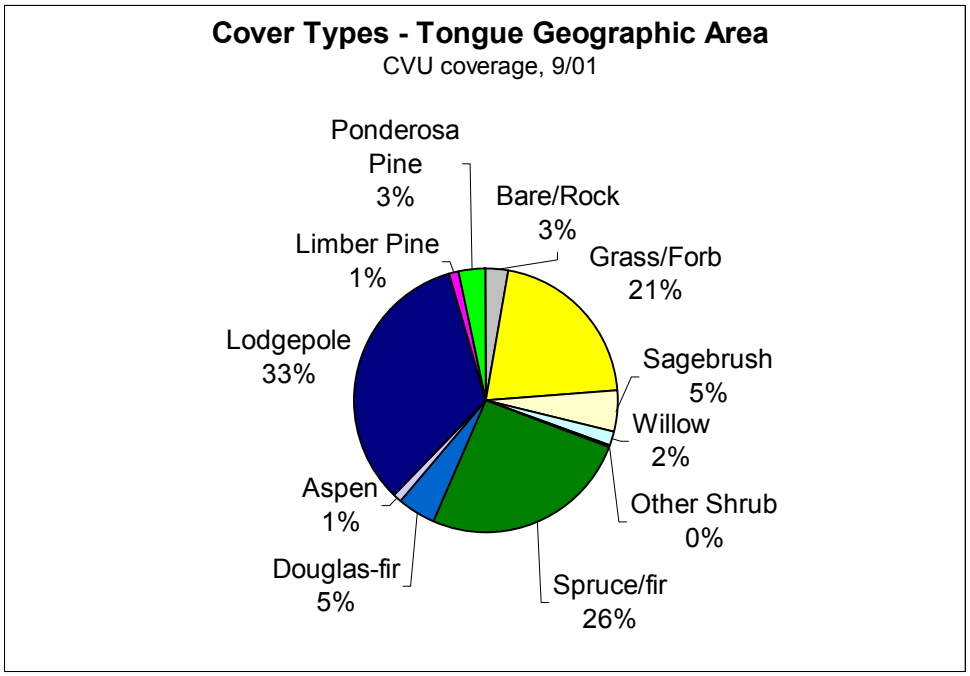


Figure 10 shows the relative amounts of the dominant cover types. Other species exist in the geographic area, but were not of sufficient size and scale to be the dominant cover type in a common vegetation unit polygon.

Figure 10. Vegetation Cover Types in the Tongue area.



The origin dates chart, figure 11, shows the stand origin dates for the forested stands in the assessment area. This data is either from the Stage II point information, or origin years were assigned to stands that regenerated after harvests or fires. The spike on the right represents timber harvest. The second spike from the right is the fires that burned the north side of Black Mountain in the 1910s. The left most spike has about equal amounts of lodgepole and Engelmann spruce; in most geographic areas, lodgepole pine has not been as represented in the oldest forests.

Figure 11. Forested Stand Origin Dates in the Tongue area

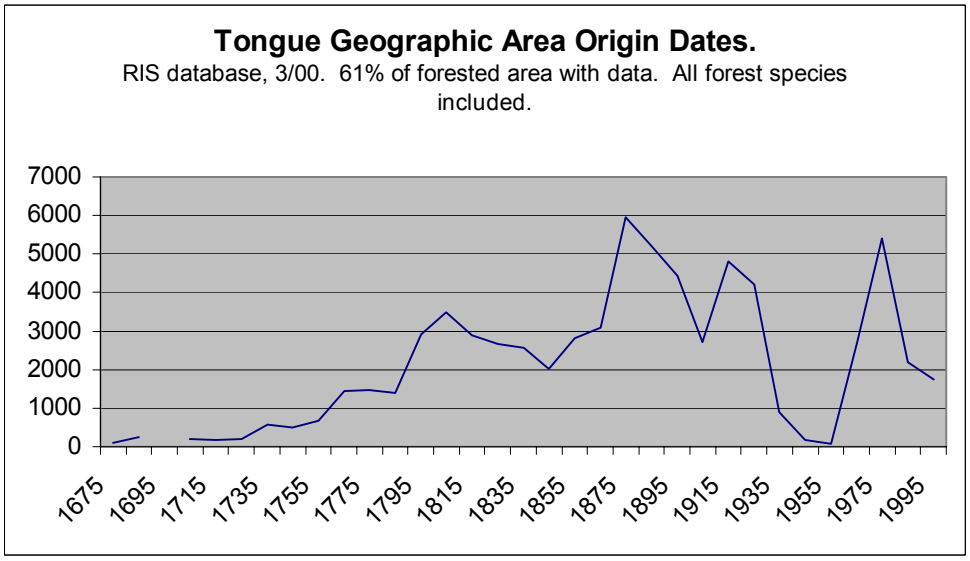


Figure 12 shows the habitat structural stages for the forests in the geographic area. Habitat structural stage provides a "coarse filter" look at habitats provided by forests in the geographic area. It gives an indication of forest size and density, which can be interpreted for wildlife habitat suitability. Forested stands provide an infinite variety of tree sizes and canopy densities, and to consider the amount, type, and spatial distribution of wildlife habitats, people need a simplified system to comprehend this variety. Many habitat considerations, such as amount and type of understory vegetation; size and amount of snags and coarse woody debris; and, the amount of hiding cover provided, can be approximately inferred from the broad habitat groupings described in the habitat structural stage model.

Habitat structural stages are defined in Hoover and Wills (1987). Structural stages describe the developmental stages of tree stands in terms of tree size and the extent of canopy closure. Structural stages can be considered a descriptor of the succession of a forested stand from regeneration, or bare ground, to maturity. For the purposes of a describing wildlife habitat, forest structural stages are divided into four categories, consisting of Stage 1, grass/forb; Stage 2, shrub/seedling; Stage 3, sapling/pole; and Stage 4, mature.

It is important to recognize that structural stages represent succession in *forested stands* only; the grass/forb, structural stage 1, refers only to forested stands that have undergone a stand replacing event, and are temporarily in a "non-forested" condition. Structural Stage 1 does not include naturally occurring meadows. The Structural Stage 1 areas are shown on the transitory forest cover type map in the appendix. These areas do not have a forested cover type in the CVU database, but they are areas that were either recently burned or harvested and have a current cover type of grass, forb, bare, wood, etc. The letter in the structural stage naming convention (a, b, or c) refers to the crown density, Table 17.

Figure 12. Habitat Structural Stages in the Tongue Geographic Area

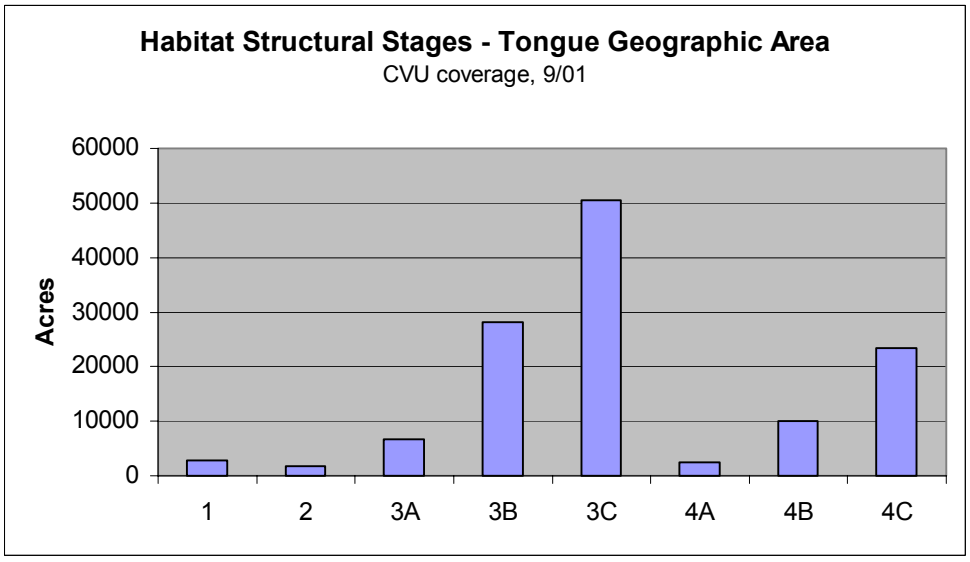


Table 17. Habitat Structural Stage Definitions, Hoover and Wills 1987

Habitat Structural Stage	Diameter	Crown Cover %	Habitat Structural Stage	Diameter	Crown Cover %
1	Not applicable	0-10%	3C	1 – 9 inches	70-100%
2	< 1 inch	10-100%	4A	9+ inches	10-40%
3A	1 – 9 inches	10-40%	4B	9+ inches	40-70%
3B	1 – 9 inches	40-70%	4C	9+ inches	70-100%

Interpretations from this table are:

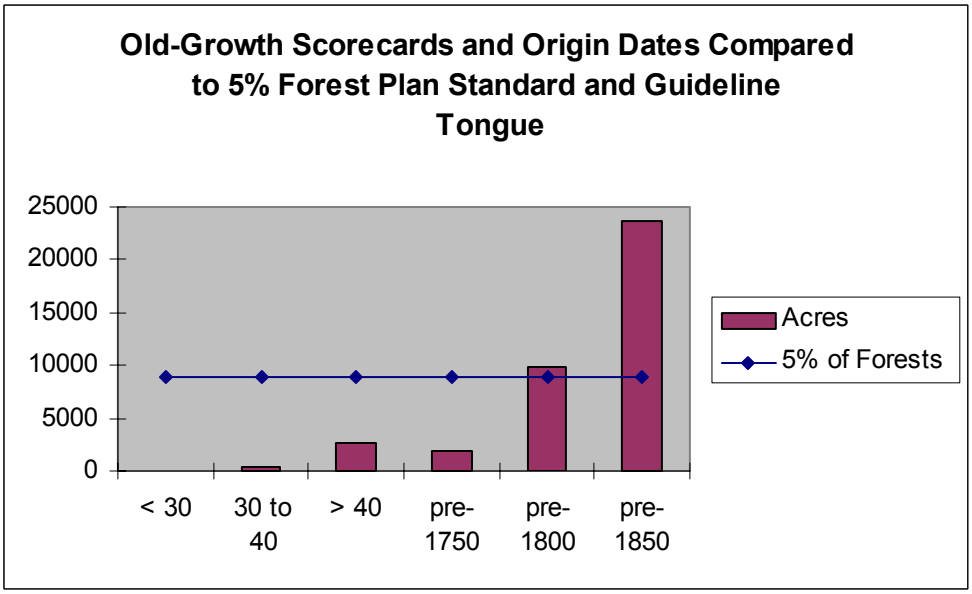
- This geographic area has large proportions of 3B and 3C habitat structural stage. The nearly 5000 acres clearcut in the 1960s and 1970s have subsequently regenerated into these classes.

Concerning old-growth, approximately 8853 acres of old-growth are needed to represent 5% of the forested area in the Tongue geographic area, which is the current Forest Plan minimum standard and guideline. Different measures of old-growth are listed in table 18 and in Figure 13:

Table 18. Old-Growth Acres

Old Growth Scorecard			Acres by Cover Type over 250 years old				Acres by Cover Type over 200 years old			
Acres <30	Acres 30-40	Acres >40	Doug-fir	Lodgepole Pine	Spruce/ fir	Limber Pine	Doug-fir	Lodgepole Pine	Spruce/ fir	Limber Pine
75	307	2726	0	571	1413	0	193	3746	5917	0
			Total Acres over 250 years old: 1984				Total Acres over 200 years old: 9856			

Figure 13. Old-Growth Scorecards and Origin Dates



Estimate the Range of Variability in vegetative conditions

- The overall change in the relative amounts of forests to meadows in the subalpine habitat types[8] changes very little, due to soil conditions (Despain, 1973). Thus, the current mix of 69% forest to about 28% grassland and shrubland, fluctuates by no more than a few percent, with most of that being in the ponderosa pine forest type.
- Because of suppression of fires in the ponderosa pine forests along the east face of the Bighorns, it is probable that the amount of forested area has increased slightly since 1890. Since Ponderosa represents only 3% of the current area, this increase can be no more than about 2%. Assuming a fire frequency interval of 25-50 years in those forests, at least two fire occurrences have been missed, causing a slight increase in the amount of forest vs. meadow in this habitat type.
- Riparian areas may fluctuate as large, catastrophically burned areas return to a forested condition, and more water is lost to transpiration and sublimation off of the forested canopy in the winter. This would only occur in watersheds and subwatersheds that have a large percentage of the watershed burned in the same event.
- Aspen is declining for three factors:
    - Long term climatic warming since the little ice age about 10,000 years ago. There was also a relative drying of the climate since that time until the last 100 years, at which point, the climate became relatively wetter. (Knight, 1994)
    - Effects on seedling survival due to wildlife and domestic livestock grazing.
    - While the subalpine fire cycle has only marginally been affected (since this type has a fire frequency interval of 100-300 years and European man has only been suppressing fires for about 100 years), continued fire suppression will decrease the amount of aspen in the geographic area, since stand replacing fire events are regeneration events for aspen.

Effects from air quality

There have been no studies to date on the Bighorn concerning air quality effects on plants. An applicable study from Yellowstone National Park concluded that ozone levels are suspected to be well below the level that would affect human health or vegetation.

Risks to ecological sustainability

- The cumulative effects of human intervention in the ecosystem. This includes:
    - People as vectors of exotic species. This includes plant and animal species.
    - Roads
    - Livestock and wildlife grazing and browsing
    - Timber harvest
    - Fire suppression
    - Recreation use

[8] Subalpine habitats include lodgepole pine and Engelmann spruce forested areas. Douglas-fir and ponderosa pine forests are not included in this generalization.

Describe reference conditions (landscapes)

One area in this geographic area was considered as a potential Research Natural Area (pRNA):

- Tongue River: This approximately 5600 acre pRNA is comprised of about 80% sedimentary substrates and about 20% granitic substrates in the Tongue River Canyon area. The Tongue River Cave is in this area. Community types include Douglas-fir, Ponderosa pine, narrowleaf cottonwood, limber pine and grasslands. 7% of this pRNA is impacted by exotic species, with the primary vector being the heavily used Tongue River trail. This pRNA is considered indefensible from human influences because of the trail.

In the Fine Filter Analysis (Welp, et al., 2000), three areas within the geographic area were considered areas "…that contain a high concentration of important taxa or representative vegetation communities." (For a complete discussion of ranking criteria, codes and descriptions, see pages 1192 to 1230 of Welp, et al., 2000):

- Woodrock, B3 rank (high significance): Contains two plant species tracked by Wyoming Natural Diversity Database (WYNDD): *Agoseris lackschewitzii* and *Aster mollis* and three animal species: common loon and the Columbia spotted and wood frogs; site captures the wetland system of streams, springs, ponds and bogs along Mohawk, Bonanza, Sucker and Copper Creeks. Old oxbows and glacial kettle ponds with dense emergent sedges support amphibians.

XI. Terrestrial Species and their Habitat

Most of the wildlife existing condition information will be presented at the Forest wide scale, since geographic areas rarely bound terrestrial species. Topics included in the forest wide scale assessment include population viability, species categories (species of local concern, species at risk, etc.), and species habitats.

General Theme/Vegetation

Wildlife species composition, distribution, and abundance are determined primarily by the distribution, structure, and composition of vegetative and non-vegetative habitat components. It is assumed that managing the vegetative components within the Historic Range of Variability (HRV) would be the most beneficial for the most wildlife species. Refer to the vegetation section description of current vegetation distribution and relevance to HRV. Of concern in this area were the riparian areas and aspen stands. Aspen are at risk from a lack of disturbance and from ungulate browsing levels. Some of the largest aspen stands on the Forest occur in the Twin Nickel timber sale area within this geographic area. Riparian areas may be at risk from livestock and wildlife grazing, dispersed recreation use, noxious weeds, and past road construction within these areas. It is assumed that priority geographic areas will be identified through this process at the Forest level to prioritize any treatment or restoration activities needed relative to HRV. There are noted cave and karst topography resources in this geographic area, more similar to the west side of the Bighorns.

Viability/Species At Risk
All information relative to these species and viability concerns will be handled from a Forest wide compilation of species, recommended conservation measures, and viability assessments. Primary information for this analysis will be derived from the WYNDD database and existing literature reviews.

WYNDD Biological Areas
The areas within the geographic area identified by Wyoming Natural Diversity Database as having a high concentration of important taxa or representative vegetation communities are described within the Vegetation section. The only biological area within the geographic area is identified as the Woodrock area, and is noted for the occurrence of spotted and wood frogs, due to the wetland habitat types in this area. In addition, sensitive plants occupy this site. Some exclosures have been built in riparian areas to protect some of these resources from livestock and recreation impacts.

Wildlife Species Information/Recommendations
Historically, *beaver* were likely more present in the geographic area than presently occur. The species is important for shaping and maintaining riparian communities. The link to deteriorated quality and reduced presence of aspen was also noted as an important consideration for this area. Aspen habitats are frequently used by beaver for dam construction when they occur in riparian areas.

- Consider beaver as a potential focal/MIS species for this geographic area area due to the habitat potential and previous use.

Elk habitat use in the geographic area would be similar to that described in the Clear/Crazy assessment. This geographic area is a major route of elk migration. In addition, there are conflicts with livestock occurring in this geographic area due to combined use of vegetative resources. In addition, elk calving may be limited in some instances due to the conflict with livestock if livestock

are present in all pastures in the spring. Issues of wildlife winter range and motorized vehicle access persist in this area, as described in the Clear/Crazy assessment. However, road access is generally less available in this area and reduces potential conflicts. The adjoining Amsden Creek Big Game Winter range is one of three along the east face of the Forest. Winter range habitat also occurs in the lower portions of the Forest in this geographic area.

There are known occupancies of sensitive bat species including *Townsend's Big-eared bat* and the *fringed myotis*, in the cave and karst elements in this canyon. These species can be impacted from habitat modifications from recreational pursuits (spelunking). The Tongue River Cave is a well-known area for this activity, and also provides habitat for sensitive species. Previous attempts to control access to the cave to preserve habitat have been met with public resistance (vandalism) and as such the cave is now largely managed as a "sacrifice spot" for recreational pursuit.

Sensitive amphibian species including the *wood frog* and the *spotted frog* inhabit wetland areas, particularly near Woodrock. The management of riparian areas to protect them from livestock and recreation impacts are of key concern.

The canyon portion of the geographic area provides abundant nesting structure for cliff nesting raptors, with potential for p*eregrine falcons, prairie falcons,* and other species. Potential issues may involve nest protection from recreational pursuits as management activities would not likely be an issue due to nesting habitat location.

This portion of the forest provides one of the largest concentrations of *ruffed grouse* known to occur on the Forest, presumably due to shrub and aspen habitats. This species is valued for hunting and wildlife viewing.

XII. Cultural, Human Uses, Land Use Patterns

Recreation and Travel Management

Summary

- The Tongue geographic area is a very important recreation area on the forest, both for summer and winter uses.
- Summer use concentrates around the developed campgrounds on US 14 and 14A and the North Tongue River fisheries.
- Winter use is extensive, with many snowmachine trails located in the analysis area as well as Sibley Lake cross-country ski trails.

Summer travel: There are a wide variety of recreation opportunities available from primitive camping and horseback riding to developed campgrounds and lodges within the analysis area. The terrain and vegetation vary widely and are characterized by timbered slopes and draws giving way to broad, open sage and grassland ridges. In the spring, there is bear hunting season and with the approach of summer, fishing, recreational driving, camping, horseback riding and hiking become popular.

Most of the C travel area near Woodrock Ranger Station is within the Tongue geographic area, where travel cross-country is authorized as long as there is no resource damage. The numbers of atv users have grown over the past five years with many user created trails appearing in the area. These routes are not authorized on the forest system of trails and often are located in wet areas and meadows.
There are many available developed campgrounds within the area including Prune Creek, Dead Swede, Tie Flume, Pine Island, Sibley Lake and North Tongue campgrounds. Burgess Junction visitor center provides interpretive displays and is open from May – September each year. There are several recreation residences located within the analysis area. In addition, two lodges/resorts are under special use permit with the Forest Service.

Winter travel: This geographic area is an important area for winter recreation use on the forest. Winter recreation use is primarily snowmobiling, followed by cross-country skiing and snowshoeing. There are approximately fifty-seven miles of state groomed snowmobile trails throughout the area. The Sibley cross-country ski trails are located in the center portion of the geographic area.

Groomed snowmobile trails are located in the southwestern portion of this geographic area. Approximately eleven miles of trail A, seven miles of trail C, five miles of trail E, two miles of trail F, twenty miles of trail H, two miles of trail K and ten miles of trail P are found within the analysis area.

Relationship between supply and demand of opportunities: This area will experience increasing pressure for summer and winter recreation use because of available access to the area in both winter and summer. Access is from FDR 149 off of FDR 168, the Freeze Out Road, US Highway 14 and 14 A, FDR 26 to Sawmill Pass from US Highway 14, FDR 16, the Black Mountain Road and several other secondary roads. Because of the location of the area close to developed sites, supply is often adequate, with exceptions on the weekend when the campgrounds may be full.

The area is experiencing increasing popularity with mountain bike use.

Recreation Opportunities: There are many recreation opportunities within the Tongue geographic area. The Forest Service describes different recreation experiences using the setting, activities and

the experience. These experiences are separated in recreation opportunity spectrum (ROS) classes. The following ROS classes and acres are found within the analysis area.

Fishing: Access to the Tongue River in Wyoming is easily accessible from US Highway 14. The upper North Tongue River is a fourteen-mile long stretch of stream that is a very popular fishery in the northern part of the Bighorn National Forest. The Wyoming Department of Game and Fish has rated the Tongue River within the canyon as a Blue Ribbon Stream – a fishery of national importance.

The Wyoming Game and Fish Department conducted extensive creel surveys and personal interviews in the Tongue River area. Surveys have been conducted in 1988, 1992 and 1999. In 1999, there were 247 Wyoming residents and 262 nonresidents interviewed during the creel survey.

There were 31 out of 82 respondents that said Forest Service land management practices affecting angler recreational experiences were high numbers of livestock causing erosion and bank damage. Seventeen responded there were no problems and thought there was good management.

The number of anglers using the upper North Tongue River in 1999 increased by three percent from 1992, however fishing pressure (angling hours) increased 73 percent and the number of trout caught increased 68 percent from 1992 to 1999. The average length of the fishing trip increased from 2.0 hours in 1988 to 3.2 hours in 1999.

Although the upper North Tongue remains an important regional fishery for resident anglers and, with a location adjacent to a heavily used route to Yellowstone National Park, is used by many tourist anglers, much of the use in 1999 was by anglers that chose this stream as a destination for their fishing trip. The 1999 survey on the upper North Tongue River estimated 5,991 anglers expended 16,935 hours from mid May through mid October.

The total estimated catch was 37,568 trout, of which 1,884 were harvested and 35,684 were released. From 1988 and 1992 (previous creel surveys) to 1999, the number of anglers using the upper North Tongue River in 1988 was 4,698, 5,821 in 1992 and 5,991 in 1999. Many anglers (59 percent) were very satisfied and an additional 30 percent were somewhat satisfied with their angling experience. Generally, anglers identified number, size and quality of the fish population, great scenery and solitude as things that positively affect their fishing experience. Conversely, things that negatively affected their fishing experience were wind, high numbers of livestock and the bank damage caused by livestock.

Hunting: Hunting season is one of the highest use seasons between September and November for archery and rifle hunting. Large camps are found throughout the area during hunting season, especially on FDR 168 towards Freezeout Point, FDR 15 on the Dayton Gulch Road and near Schuler Park. The horse camps usually bring their own supply of hay.

Trails: There are several motorized and nonmotorized trails within the project area. The lower portion of the Tongue River Canyon trail is accessible to hikers and horseback riders. The area is also increasingly popular with rock climbers. The Wolf Creek Trail is easily accessed from Eaton's Guest Ranch and visitors frequently ride horses to the Bear Creek Camp. The Shutts Flat trail from Arrowhead Lodge through Shutts Flats to FDR 26 is a popular motorized trail.

Table 19. Recreation Opportunity Spectrum (ROS) Classes within the Tongue Analysis Area

ROS class	Acres in analysis area	Percent
Primitive	3,156	2
Semi-primitive nonmotorized	29,983	17
Semi-primitive motorized	61,768	35
Roaded natural	41,755	24
Roaded modified	28,845	16
Rural	11,221	6

As displayed on table19, the eight-one area percent of the geographic area is in motorized ROS classes. This geographic area has a higher percentage of motorized use than most of the other geographic areas on the forest. The semi-primitive nonmotorized and primitive acres are located in the eastern portion of the geographic area.

Primitive – 3,156 acres
These areas are characterized by an unmodified environment and have a very high probability of experiencing solitude, freedom, closeness to nature, tranquility, self-reliance, challenge and risk. There is very low interaction between recreation users. Access and travel is nonmotorized on trails or cross-country.

Semi-primitive nonmotorized – 29,983 acres
Areas in a semi-primitive nonmotorized class are in a natural appearing environment with a high probability of experiencing solitude, closeness to nature, tranquility, self-reliance, challenge and risk. There is low interaction between users. Access and travel is nonmotorized on trails, some primitive roads or cross-country.

Semi-primitive motorized – 61,768 acres
There is a moderate probability of experiencing solitude, closeness to nature and tranquility. The setting is in a predominantly natural appearing environment. There is a low concentration of users, but often evidence of others on trails. Motorized vehicles are allowed for travel.

Roaded natural – 41,755 acres
Self-reliance on outdoor skill is of only moderate importance to the recreation user with little challenge and risk. The environment is mostly natural appearing. Access and travel is motorized including sedan and trailers.

Roaded modified – 28,845 acres
In a roaded modified setting, there is opportunity to get away from others, but with easy access. There is moderate evidence of other users on roads and little evidence of others or interaction at campsites. Conventional motorized access includes sedan, trailer, atv and motorcycle travel.

Rural – 11,221 acres
The opportunity to observe and affiliate with other users is important, as is convenience of facilities and recreation opportunities. There is little challenge and risk. Interaction between users may be high as is evidence of other users.

Special Areas:
Within the analysis area, there are approximately 14,373 acres of 10D management area prescription, Wild and Scenic River Management. The majority of the wild and scenic study area is within a grazing allotment.

The Tongue River is free flowing. The scenery of the area is considered outstandingly remarkable and is characterized by towering, colorful cliffs, river gorges and many series of rapids. In the 1985 Forest Plan, three segments of the Tongue River were found eligible for wild and scenic river study. Segment A is fourteen miles, from the bridge at Tongue River Canyon to Burgess Picnic Ground. There are no developments along this segment of river.

Segment B is fourteen miles from the North Fork fo the Tongue River from Burgess Picnic Ground to Pole Creek. Within Segment B, there are two recreation facilities – Burgess Picnic Ground and North Tongue Campground. U.S. Highway 14A runs parallel to the North Fork for about nine miles. Segment C is 2.5 miles on the South Fork of the Tongue River to Johnson Creek. With the exception of limited access to the four summer homes in the area, there is no developed access to Segment C. The forest will continue to protect those segments of the Tongue River that were found eligible for wild and scenic river study.

Grazing

In 1995 the Bighorn National Forest in conjunction with the University of Wyoming Department of Renewable Resources, University of Wyoming Extension Service, and Bighorn National Forest Grazing Permittees Association developed the ***Bighorn National Forest Vegetation Grazing Guidelines.*** These guidelines were revised in 1996 and finalized on April 9, 1997.

The Guidelines outline vegetation-monitoring requirements for riparian areas on the Forest. This monitoring is mandatory for all allotments on the Forest with penalties established if the monitoring is not completed. The Forest rangeland management personnel spot check permittee monitoring and if discrepancies are found they are resolved on the ground or Forest Service data is used as the baseline for that season. Upland vegetative standards are outlined in the 1985 Bighorn National Forest Plan and still apply to all upland use.

Bighorn National Forest staff are in the process of completing geographic area level Allotment Management Plans (AMPs). The Tongue AMPs are in the process of being completed during the summer of 2001. Until the geographic area level AMPs are complete, existing AMPs will remain in affect and Annual Operating Instructions will be used to adjust the Plans to fit current resource objectives and assure management meets existing on the ground needs.

To assure objectives are being met annually the Forest Service, permittees or both complete riparian and upland monitoring. If problems occur adjustments in grazing use (changes in season of use, livestock numbers, rest periods, or deferment of on-dates) are made to allow the herbaceous vegetation to recover.

Table 20 shows selected information for the six grazing allotments in the Tongue analysis area.

Table 20. Select Information for Grazing Allotments in the Tongue Analysis Area

Allotment	Livestock Permitted	Number Permitees	Total Acres	Capable Acres	Current AMP	Scheduled AMP Update	Permitted Season
Amsden C&H	81 C/C 75 Y	1	2770	1,294	1986	2002	7/4 - 10/10
Copper Cr/Upper Dry Fork C&H	900 Y	1	18409	3358	1980	2002	6/20 - 9/15
Freezeout C&H	1269 C/C 258 Y	8	27,200	9589	1980	2002	6/16 - 10/10 6/1 to 9/10
Little Tongue C&H	375 C/C	2	25,650	5,616	1984	2002	6/21 to 10/5
Lower Tongue C&H	1998 C/C 240 Y	6	13,440	7,937	1981	2002	6/16 to 10/10 6/16 to 9/10
Nicklemine C&H	181 C/C 945 Y	3	8481	2354	1984	2002	6/16 to 10/10 7/1 to10/10
Pass Creek C&H	310 C/C 100 Y	1	15425	2,883	1982.	2002	6/26 to 10/5 7/20 to 10/5
Prospect Cedar C&H	169 C/C	1	5899	3,402	1983	2002	7/6 to 10/5
Upper Tongue C&H	710 C/C	2	10635	3586	1984	2002	6/16 to 10/10
Wolf Creek C&H	338 C/C	2	8329	1,788	1983	2002	6/21 to 9/25
Bull Creek S&G	Variable Season	1	18121	11712	1980	2002	7/1 to 9/30
Fishhook S&G	600 S	*	4365	2,364	1983	2002	7/6 to 9/18
Fool Creek S&G	1200 S	*	7502	1,858	1982	2002	7/6 to 9/18
Lookout Mtn. S&G	0	Vacant	8,317	4,248	Vacant	2002	
Owen Creek S&G	1450 S 320Y	1	4907	1939	1964	2002	7/4 to 9/5 7/7 to 9/5
Pole Creek S&G	1200 S	*	3133	2079	1985	2002	7/6 to 9/15
Spring Creek S&G	1200 S	1	2,500	121145	1984	2002	7/6 to9/5 (30 days)
Wallrock/Hidden Teepee S&G	1500 S	1	8991	5853	1981	2002	7/1 to 9/15

The geographic area analysis was initiated in 1999. Under the current schedule the NEPA analysis is scheduled for completion in 2002 and the AMP's updated in 2003. Current delays are primarily based on the complexity of allotments in the Tongue geographic area, potential controversy of management decisions and cultural resource impacts. If the cultural resource surveys are completed on schedule this timeframe should hold firm. The Decision Notice and AMP's would be delayed a year if delays are encountered with the surveys.

Overall the herbaceous vegetation on the sheep allotments is in good condition with static to upward trends. Isolated areas occur where vegetation use exceeds standards and guides but corrective action is taken the year following the excessive use to allow these areas to recover. The cattle allotments are heavily stocked and having problems meeting current Forest Plan standards and guides. The decision selected through the NEPA analysis will strive to identify standards and guides and work with permittees to meet them. These standards and guides will be implemented though the AMP developed in conjunction with the permittees.

Historic and cultural sites

Since Forest Plans are programmatic documents, this topic will only be briefly discussed in this geographic area assessment. Analysis of cultural resource will be by unified entities segregated by site types, time periods, and spatial relationships within a specific historic context/theme (e.g., pre-1890s sheep grazing, southern Big Horn Mountains). This document will not discuss individual cultural resources, as such discussions are more appropriate to site specific analysis. The exception is a site that is classified as a Native American Traditional Cultural Property (TCP) as define by Bulletin 38; direction issued under the National Park Service[9].

Management area allocation, specifically special area designation, would be the most likely Forest Plan decision that could affect heritage resources, and the affect would be at the landscape level versus site specific. Based on monitoring and the analysis to date, it appears that several sets of the heritage resources types in the Tongue Geographic area are interrelated, and can be define as cultural landscapes. Some of these entities can be managed under the project-level protections currently in place, but several should be considered for additional study to determine if they need a specific Forest Plan level special area designation.

A summary of cultural resources found in the analysis area follows:

PRE-EUROPEAN:
Based on cultural resource inventories, historic documents, and interviews/oral traditions, people have used the Tongue geographic area for at least 10,000 years. Archeological data, in the form of diagnostic artifacts, reflect that the area was inhabited or used by cultural complexes typical of the regional as defined by past works (see Frison 1991). Additionally, the properties representing past inhabitants are rich in diversity and significant data on past lifeways in the Big Horn Mountains. Site types include large and small camps that can be represented by dense and diverse stone tool assemblage and/or by stone features such as stone rings that are the remnants of tipi villages. Other site-types include hunting, bison processing, plant gathering and processing sites, lithic workshops for the production of stone tools, quarries, trails/travel corridors, and ceremonial sites.

As seen in previous analysis areas, portions of the project area that contain historically large stands of lodgepole pine have low site densities, while areas with a variety of ecotones have high site densities. It is not surprise to fine the highest site densities along travel corridors that are located in diverse ecotones. These corridors were established in response to physically geological phenomena (e.g., steep versus gentle mountain slopes and ridges), as well as in response to learned behavior as in knowledge of plant and animal resources.

Exceptions to high site densities occurrences are known. They are due to a needed resource being fixed and non-mobile, and people have to specifically travel to the resource for utilization. A good example of a fixed highly valued resource is a stone tool quarry in the middle of a large expanse of timber. However, access to the resource will normally occur by an establish travel corridor. The corridor thus becomes a unifying entity for distinguishing potential cultural landscapes. In the Tongue analysis area, three known significant prehistoric travel corridors exist

[9] Under the National Historic Preservation Act (Act), the Advisory Council on Historic Preservation (Council) was establish, and is under the authority of the Interior Department, specifically, the Park Service. The Council is empowered under the Act, to propagate rules and regulations for the management of cultural resources. One of its means is by the publication of Bulletins publish through the Park Service. TCPs are special sites that are important to American Indian Tribes for the carrying out of traditional lifeways/beliefs. Without access to these sites, native peoples would inure a burden in maintaining critical practices essential to their cultural identity and well-being. Laws (e.g., Native American Freedom of Religious Act), and Executive order 13007 direct federal agencies to manage such sites for the use by indigenous peoples.

and are 48SH710, 48SH1159 and 48SH923. All three sites rank as Level 1[10] type properties, and all three have discrete portions that could be manage as representative areas/districts/landscapes. Ranking[11] among them, based on ideas such as national versus local significance, pristine visuals, and potential conflicts with other resources, are 48SH710 as the highest, than SH1159, than SH923.

Three other prehistoric cultural landscapes (TCPs) exist in the project area. Because of the sensitive nature[12] of the sites, they are noted here to highlight a need for consideration in the planning process, but will not be discussed in detail nor named. It is suggested that TCPs, for purposes of Forest Planning, generally be managed by visual quality standards. By this means, specific localities will not be overtly identified. However, in rare occasions, a specific management prescription may constitute the appropriate management tool (e.g., Bighorn Medicine Wheel, National Historic Landmark), and should be determine by discussion among the Planning team, and impute by the public at a generic level, and specific impute by the appropriate tribal government.

EUROPEAN:

In general, across the Forest, fur trapping (ca. 1812-40s; time period 1) was the first use by Euro-Americans, followed by prospecting and military exploration (1860s to 1880s), than the early settlement period (ca. 1880s to 1915) that included prospecting, introduction of grazing, and the establishment of a timber industry. The last Historic Period, for convenience, is the era of establishment and management of the Forest by the Federal Government (ca. 1907 to present[13]; time period 4). These time periods 1 through 4 will be used for the outline of discussion.

Period 1: Only one known site type is associated with this time period, and it is travel routes. It has been document that fur traders did use trails established in prehistory to travel into the Big Horn Mountains. These trails are the same trails as noted in the prehistoric discussion above. However, no physical data has been found of this use, such as a camp. Direction here would be that management of the trails as noted above would include basic visual and physical needs to protect portions of the trail system as a representative same of the time period, which for all practical purposes resembles a prehistoric trail.

Period 2: No sites associated with prospecting are known to exist in the area. Three trails, 48SH710, 48SH1157 and SH923, are associate with military history. These trails significance have already been noted in the prehistory section.

Period 3: No significant landscape associated with prospecting or mining is known to exist in the area. Significant Grazing landscapes are associated with the three trails note above. One significant timber industry district has been identified in the project area. The district has had a management plan written for it, and is referred to as the Woodrock Tie-Hack District.

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[10] Level = Extremely Significant Data present that could answer several research questions over several time periods and themes, Level 2 = Extremely Significant Data present that could answer several research questions, but limited to only a few themes/time periods; Level 3 Significant Data present, but limited to only a one or two themes/time periods.

[11] Ranking here is only from the cultural resource specialist perspective, and could change after analysis by the Forest Plan team.

[12] Under the law (e.g., NHPA), the location of eligible properties is considered "confidential" information, and not to be displayed or distribute to the general public, unless there is a need. Additional guidance and requirements (36CFR800) are associated TCPs. Part of the requirements includes consultation with tribes that attach "religious and cultural significance" to a property. At present, tribes only want the Forest to give out the lease amount of information on TCPs. Therefore, this report only notes their presences.

[13] Based on regulations, in order for a site to be classified as a cultural resource, it has to be 50 years old. For purposes of this document, 1950 is the end date for the analysis.

Period 4: Under this last period, some of the more noted themes/landscapes are developed recreational program for recreational summer homes, Sibley Lake Dam built by the Civilian Conservation Corp, and Forest Service administration sites such as Burgess Junction Ranger Station and the Black Mountain Fire Lookout.

Paleontological Resources

There are several locations within the study area where non-vertebra paleontologic resources can be found.

XIII. Transportation System (Roads and Trails)

A forest-wide roads analysis will be conducted during the effects analysis part of Forest Plan revision. It will be done under the 1985 Forest Plan direction. When the revised Forest Plan is implemented, the roads analysis will be reviewed and applicable revisions made.

Roads

There are currently approximately 370 miles of roads in the Tongue Analysis Area. This system of roads accesses an area of approximately 277 square miles, including wilderness and private lands. The road system in this analysis area varies from high standard US Highways to primitive, abandoned wheel tracks. The following table gives a breakdown of roads within the analysis area:

Table 21. Miles of Road by Jurisdiction

Jurisdiction	Length (miles)
Forest Service	323.7
Unclassified	45.86
Total:	**369.6**

The roads within the analysis area under Forest Service jurisdiction are divided into categories called maintenance levels. Maintenance levels range from 1-5, with 5 being the highest standard, and 1 being the lowest standard. There may also be additional roads no longer required for management purposes, or which have been created by off road vehicle use, but there still exists a road 'footprint'. These roads are called unclassified, and the mileage of these unclassified roads is an approximation. A description of maintenance levels is shown in Table 22.

Table 22. Description of Road Maintenance Levels

Maintenance Level	Description
1	Closed to public travel – can be used intermittently for management purposes.
2	Maintained for use by high clearance vehicles.
3	Maintained for use by a prudent driver in a passenger car.
4	Maintained for use by passenger cars with a moderate degree of user comfort. Usually double lane, gravel roads.
5	Maintained for a high degree of user comfort, double lane, often paved.

Figure 14 shows a breakdown of Forest Service roads within the analysis area by maintenance level, as well as other roads within the analysis area by jurisdiction.

Figure 14. Roads by Forest Service Maintenance Level

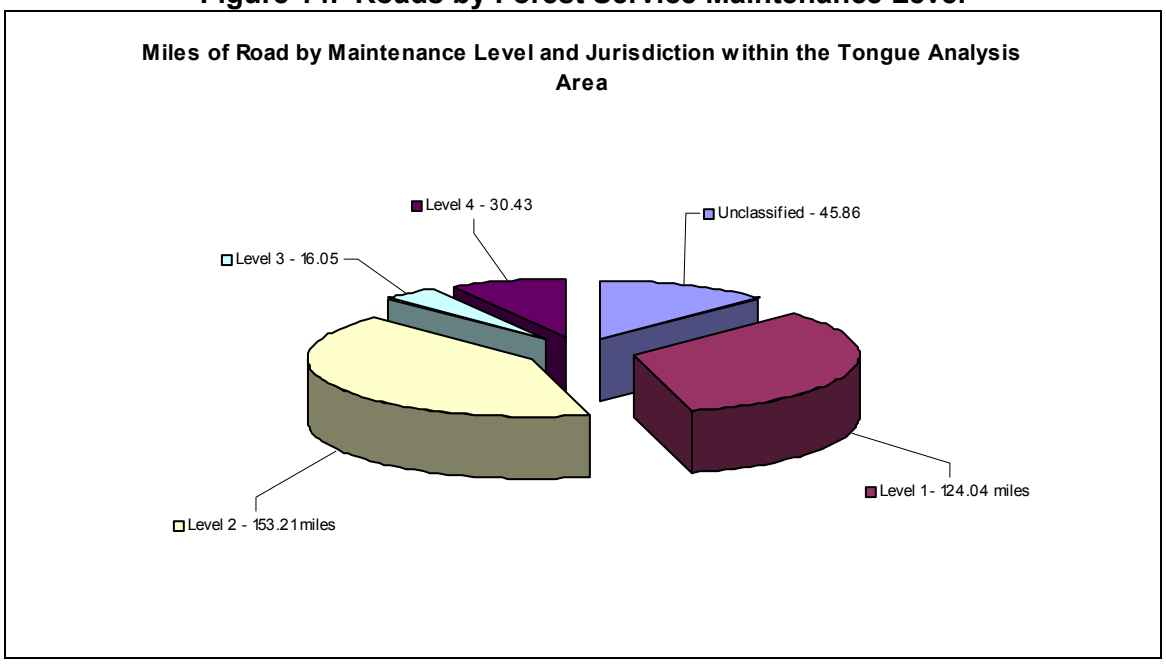


Table 23 lists the road density in the Tongue analysis area. These figures do not include wilderness and private land. The open road density does not include unclassified roads.

Table 23. Road Density in Tongue Analysis Area (National Forest System, Non-wilderness land only)

Total Road Density	1.36 miles per square mile
Open Road Density	0.73 miles per square mile

Various structures and components are needed to manage and operate those roads under Forest Service jurisdiction. These structures include bridges, culverts, cattleguards, waterbars, rolling dips, gates, and signs. These structures along with the roads themselves represent a great investment in the transportation system, as well as a great cost for annual maintenance and, over the years, a resulting backlog of maintenance needs. Table 24 shows the breakdown of annual and deferred maintenance needs by maintenance level[14].

[14] Costs arrived from performing condition surveys on each level 3, 4, and 5 road on the Bighorn National Forest in 1999, and from a random sample of level 1 and 2 roads in 2000. Costs per mile were interpolated from these surveys. Also, these costs do not reflect annual and deferred costs for bridges. Those costs are not yet readily available.

Table 24. Annual and Deferred Maintenance Needs by Maintenance Level

Maintenance Level	Miles	Annual Cost/Mile	Deferred Cost/Mile
1	124.04	$683	$886
2	153.21	$920	$2,316
3	16.05	$6,561	$8,109
4	30.43	$5,991	$14,730
Total needs for annual maintenance in Tongue = $ 513,287			
Total needs for deferred maintenance in Tongue = $ 1,043,117			

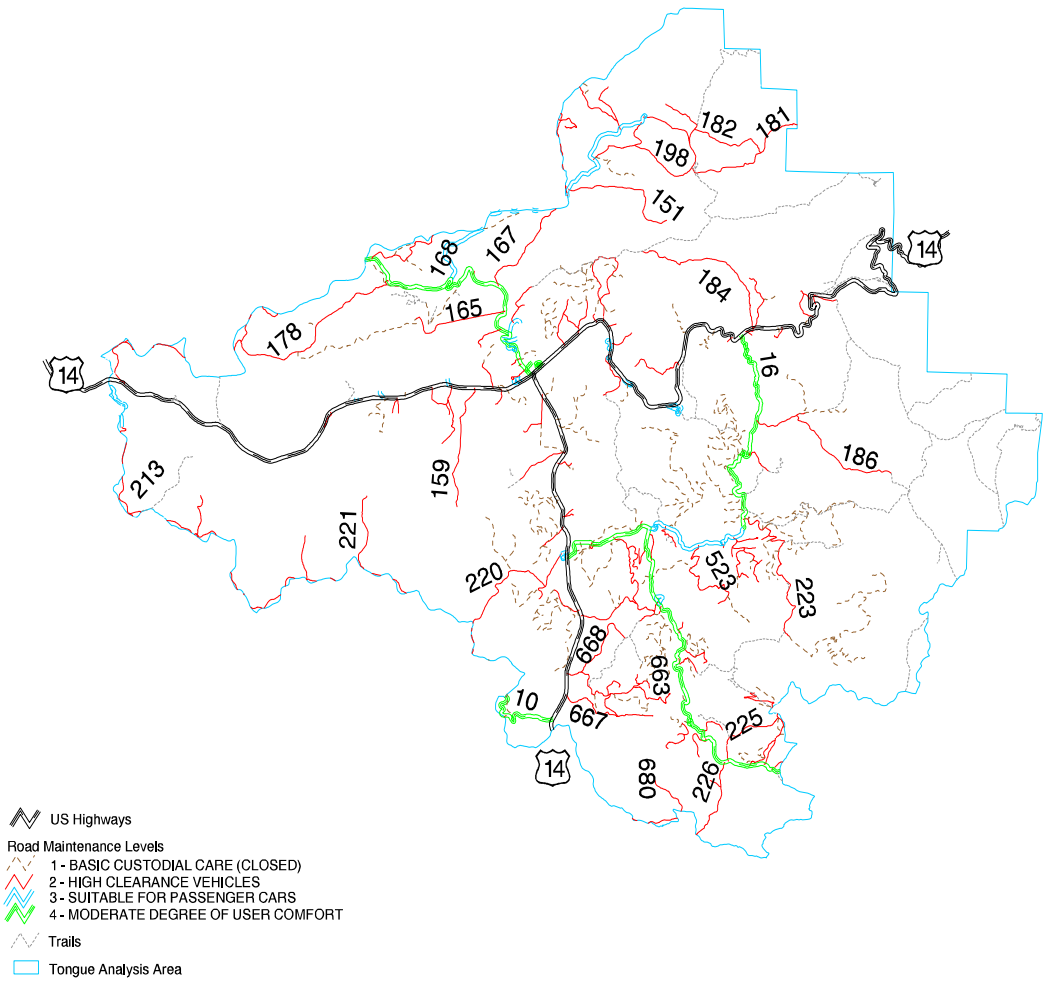
Current funding levels for road maintenance over the past 3 years have remained fairly constant, with an approximate allocation of $460,000. This amount is far below the level needed for full implementation of the current transportation system forest wide. Current forest plan standard for full maintenance is also not being met under current allocations. Currently, general plan direction states to keep roads open to public use unless financing is not available to maintain the facility, or use is causing unacceptable damage to soil and water resources. Based on current deferred maintenance and annual maintenance needs, plan direction is not being met.

Forest Plan Goals/Desired Conditions

Forest Plan direction for road management and operations are primarily based on resource needs rather than the road systems as a separate entity. In other words, the driving force behind road management decisions are primarily based on the management directions resource needs for an area. The Forest Plan does, however, give direction that roads may be closed if financing is not available to maintain the facility, if use is causing unacceptable resource damage, if they are unsafe, or if their use conflicts with the management objectives for an area. The Forest Plan also states that arterial and collector roads shall be maintained to a minimum maintenance level of 3, and all open local roads shall be maintained to a minimum maintenance level of 2. In contrast, forest plan goals to provide additional road and trail access to the National Forest boundary are being met.

The map on page 51 shows the current Forest Service Road system by maintenance level in the Tongue analysis area.

Road Display by Maintenance Level for Tongue Analysis Area



Trails

There are currently approximately 89 miles of trail in the Tongue Analysis Area. This trail system accesses an area of approximately 277 square miles, including 0.007 square miles of wilderness. The trail system in the analysis area varies from high standard ATV trails to primitive single-track trails. The majority of the trails within the analysis area are constructed and maintained by the forest service. However, there is also a small length of trails in the analysis that are user created, or are abandoned trails that still have an existing footprint. These trails are referred to as unclassified. Table 25 shows the breakdown of classified and unclassified trails within the analysis area.

Table 25. Miles of Trail by Status in Tongue

Trail Status	Length (Miles)
Forest Service	89.08

Forest Plan Goals/Desired Conditions

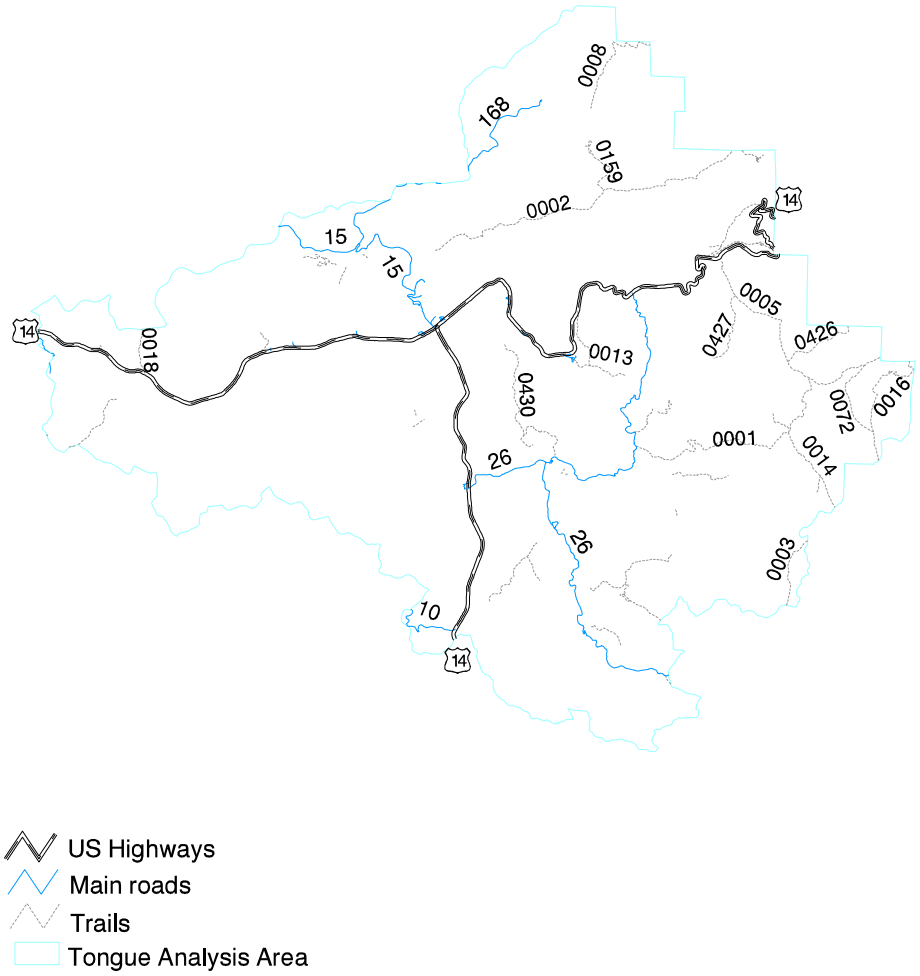
Forest Plan direction for transportation facilities are primarily based on resource needs rather than the road systems as a separate entity. In other words, the driving force behind road management decisions are primarily based on the management directions resource needs for an area. Currently, general plan direction states to maintain all trails to certain minimum requirements, including maintaining drainage structures to prevent unacceptable resource damage, and to remove all hazards from trails to allow safe passage for specified classes of users. For the most part, this direction of the plan is being met, however, deferred maintenance surveys have revealed that a lack of a steady budget in trail maintenance has caused some degradation of the trail system that is not consistent with current plan direction. In contrast, plan direction for providing a full range of trail opportunities in coordination with other state, federal and county municipal jurisdictions and private industries is generally being met.

The current annual trail maintenance need is estimated to be $1,217 per mile and deferred maintenance costs are estimated to be $13,125 per mile[15]. Total trail maintenance needs in the Tongue analysis area are estimated to be $108,410 annually maintenance, with a $1,169,175 deferred maintenance backlog.

The map on page 53 shows the current trail system within the Tongue analysis area.

[15] These costs are interpolated from the forest wide condition survey assessments done in 2000 and 2001.

TRAIL DISPLAY FOR TONGUE ANALYSIS AREA



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